Building Hanok

Components & Techniques

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Components & Techniques

Architecture &
Urban Research Institute

Since humankind settled for life in certain areas, architecture has developed while adjusting to the local environment. Regional characteristics are gradually disappearing in the modern period. Nevertheless, different parts of the country keep the distinctive architectural features that are connected to the local natural environment as well as historical and social backgrounds, which distinguish them from the other regions. Such architectural distinction for Korea is represented by the form of Hanok, which is carried on to this day.

As Korean society weathered rapid modernization, Hanok was cold-shouldered as old, inconvenient, and uneconomical in the past. On the other side, there was misperception that insisted on the form of Hanok for all Korean-style architecture, which resulted in the all-around reproduction of a certain aspect of a specific Hanok. Over the last 20 or so years at the end of such convolutions, there have been various attempts to build such Hanok as provides convenience, stylishness, and financial value even while retaining the traditional look of Hanok. Now, Hanok is being reborn as Korea's representative architectural form to which not only Korean nationals but also foreign tourists pay much attention while praising the eco-friendly materials, the beautiful appearance, the functional space inside etc.

This book is designed to help foreigners who are interested in Hanok to get an architectural understanding of it. There are Korean-language publications at various levels on Hanok, but we have very few publications that can explain Hanok to foreigners. Especially because Hanok differs from the western architecture in materials, form of parts, building method etc., one can understand Hanok more easily and completely by taking a bird's-eye view of the components and construction of Hanok. Not through viewing the appearance of a finished

Hanok, but by looking at the process in which different parts that make up a Hanok, one can have a systematic understanding of Hanok.

The book has been planned and created by National Hanok Center in Architecture & Urban Research Institute (AURI) with a view to bringing international publicity to Hanok and spreading it worldwide. AURI is a national research institute that studies the architectural and urban policy in Korea. As one of our key research divisions, National Hanok Center conducts research and provides advice on Hanok, the traditional architectural form of Korea, and works to revive the Hanok culture by planning and revising the country's Hanok policy. Since it was created in 2011, National Hanok Center has delivered a number of publications through countless researches related on Hanok. This book is a rewrite of Hanok Construction Practice Manual that National Hanok Center published 2012, which is designed to facilitate its understanding by foreigners.

Recently, Hanok is built in different countries, while foreigners come to Korea to live in Hanok or to study it. I hope that this book will not only enkindle interest in Hanok, but also serve as a good textbook that deepens the architectural understanding of foreigners who are familiar with Hanok. Meanwhile, I hope that Hanok will develop further through communication with contemporary architecture and exchanging inspirations that can make up mutual deficiencies.

December, 2017

Kim, Dae Ik

President of Architecture & Urban Research Institute (AURI)

Coming into the 21st century, Hanok, the Korean traditional architectural style, has drawn attention at home and abroad. The traditional wooden architecture, which consists in making a framework with wooden posts and crossbeams and putting a sloped tiled roof on top of it, has long been used as the main architectural style in Korea. Since the late 19th-century opening of trade ports when the Western modern architecture was introduced, brickbuilt architecture and reinforced concrete architecture began to be used one after another, but that doesn't mean that the traditional wooden architecture disappeared all at once. To narrow it down to residential housing, wooden Hanok formed the mainstream as late as in the 1960s.

In a short span of just 50 years, however, it is quite difficult to find Hanok around. New surge of interest in Hanok comes from the fatigue caused by the drastic change to the urban architectural landscape. An attempt to find distinction and diversity in an overly uniform housing market, fresh evaluation of the atmosphere and mood that surpass the convenience of an apartment, and the differentiated redevelopment strategy for backward old city centers have led to the rediscovery of the value of Hanok.

In responding to such renaissance of Hanok, this book aims for spreading the experiments conducted at architectural schools to society in general. It was in 2008 that the colleges came up with courses about the Hanok design and construction for learning through practice, an attempt that never appeared before . Seoul National University was the first to try it, and then identical courses followed in Myeongji University, Kangwon National University, and Kyungpook National University. The courses typically have professional carpenters coach students in completing a whole Hanok. They came to a weekly class and guided students in their practice, and special tasks such as involving doors, windows, and roofs were handled by artisans while students watched it. As the house had to be finished within the short span of a semester, a typical outcome had to be as small as two or three kan ('a square about six feet wide and long').

A total project proceeded for total fifteen classes, once a week, through a 15-week semester. At Seoul National University, where there were some fuss over the relocation related to construction permission, the course got prolonged to the two semesters of fall 2008 and spring 2009. However, the original goal was a 15-session period. All the details of the coursework were summarized in a report, which incorporated daily work reports as well as graphic documents such as drawings and photo images. Following the creation of the report, National Hanok Center affiliated with Architecture & Urban Research Institute (AURI) edited it into a book titled Hanok Construction Practice Manual in 2012.

The book, which places the Seoul National University report at its center and fills its partial deficiencies with the specifics of the project at Kyungpook National University, provides a cover-to-cover description of the construction of a whole Hanok. This publication was designed to deliver an easy-to-follow explication of the Hanok construction to the general public. It also carried the intention to spread out practical Hanok construction knowledge to local communities and educational institutions of different academic levels. In a nutshell, the book was meant as a practice manual.

Hanok Construction Practice Manual unexpectedly met favorable reaction and went through several prints. Furthermore, many people suggested English publication to introduce contents for foreign readers, and we have come to make this edition. Publishing a book in English requires further considerations beyond simple translation. To begin with, it should focus more on broadening readers' understanding of Hanok in general rather than being a practice manual as foreign readers have far fewer opportunities to experience Hanok. Additionally, since foreigners are more exposed to the Japanese or Chinese architecture than to the Korean counterpart, it is necessary to compare traditional architecture of these three countries.

Accordingly, we have added a section on Hanok construction in general on top of specific types of Hanok. We have also greatly upgraded the illustrations. As technical terms are frequently used, no matter how simple the explanations are, there should be many difficulties for foreign readers to thoroughly understand. So, by reducing text while increasing images, we have made the Hanok construction process easy to follow. Illustrations were handled by Kwon Ah-song of SNU Architectural History Lab. Basically, specific parts are highlighted over a 3D image of the whole building, and we drew additional images for those parts that are not covered.

That said, translation of terminology involved inevitable difficulties, so we had meetings continuously. Then, we concluded that we could perhaps use the occasion to create a Korean-English dictionary for Hanok terminology. So, we have come up with Part 2 of this edition, which is not included in the Korean edition. As a result, Part 1 gives a sequential description of the Hanok construction, and Part 2 explains the parts and tools used in building Hanok, rituals conducted during the construction, and the planning principles and construction techniques.

Translating Hanok-related terminology involves multi-dimensional issues. Most critical issue was whether to adopt phonetic transcription or use translation reflecting the right meaning. For example, the phonetic transcription of Hanok was used to refer to the traditional Korean wooden architecture or, narrowly, the traditional wooden housing; same principle was applied to major, frequently used terms such as ondol and maru. Problem was with terms of lower categories such as dori, daegong, and seokkarae. It wasn't easy to arrive at a principle. This problem isn't limited to components, but has some bearing on all elements including tools, materials, techniques, decorations, and rituals.

In this book, we wanted to carry everything from Korean terminology and English pronunciations, to Sino-Korean writings, equivalents in Western architecture, and their rephrased explanations.

Secondly, since Hanok differs from Western architecture, it is hard to find the precise translation for a meaning-based transfer. While there may be similar words, the right words are hard to find, and if all terms are phonetically transferred, readability should be much compromised. We chose those terms of Western architecture with the closest possible meaning, and let the illustrations fill the gaps. Comparing the Korean architecture with the similar-looking Chinese or Japanese equivalent posed even greater difficulty.

Thus, we have inserted a comparison table for the architectural terminology of Korea, China, and Japan in the beginning of Part 2. For this, we found much help from, Dr. Cha Ju-hwan, Prof. Hyun Seung Wook and Dr. Kim Min-suk, who studied the traditional architecture in China and Japan, respectively.

By choosing to focus its description on the Hanok construction process, this book is set apart from other books on Hanok. It provides a perspective that follows the construction process from parts to whole, and from inside to outside. This lets readers have an idea of what principles organize Hanok.

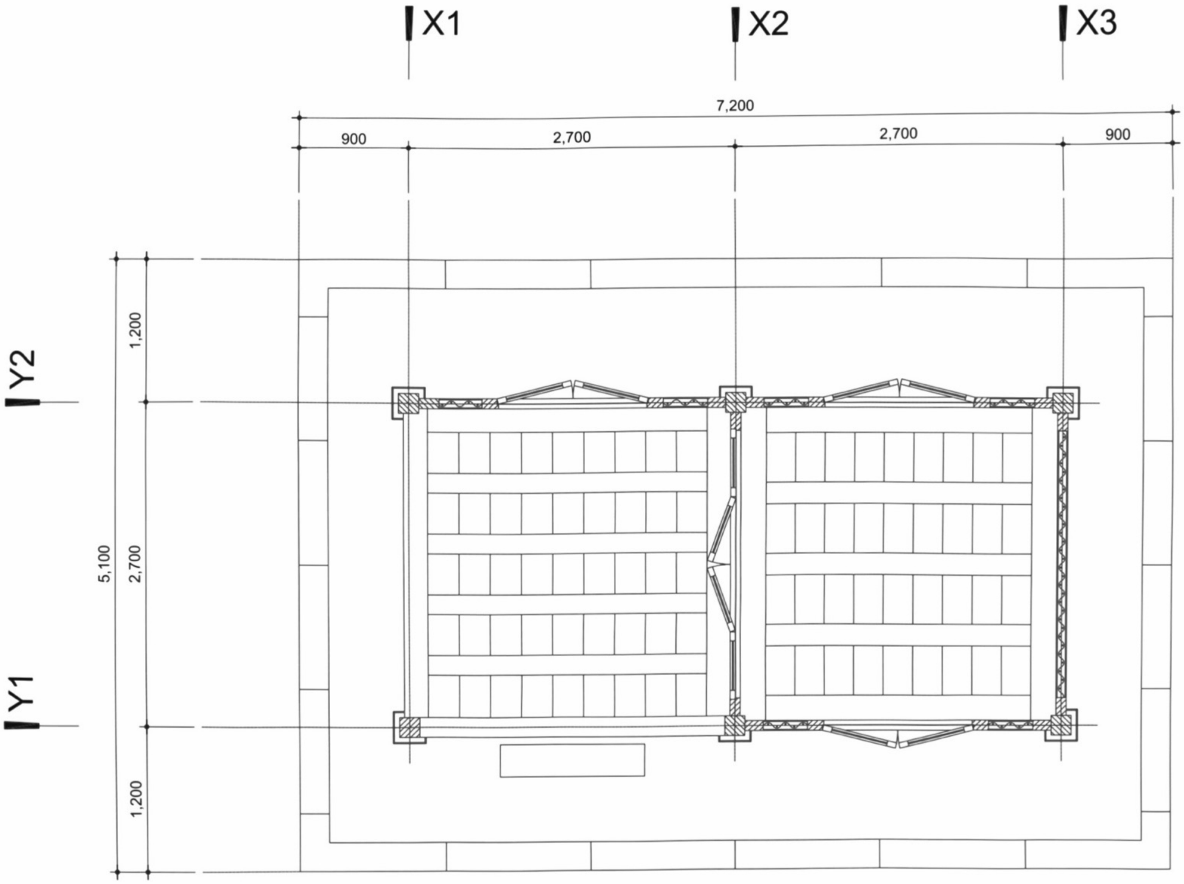
It is our hope that this book will provide a basic understanding of Hanok for those who are new learners of the traditional Korean architecture.

Last but not the least, I want to give thanks to President Kim Dae Ik of AURI for his support that has enabled the publication of this book, and to Associate Research Fellow Lee Geauchul and Assistant Research Fellow Kim Jongbum, who have handled the project and the editing of the book, for their hard work.

December, 2017

Jeon, BongHee

Professor, Department of Architecture and Architectural Engineering
in Seoul National University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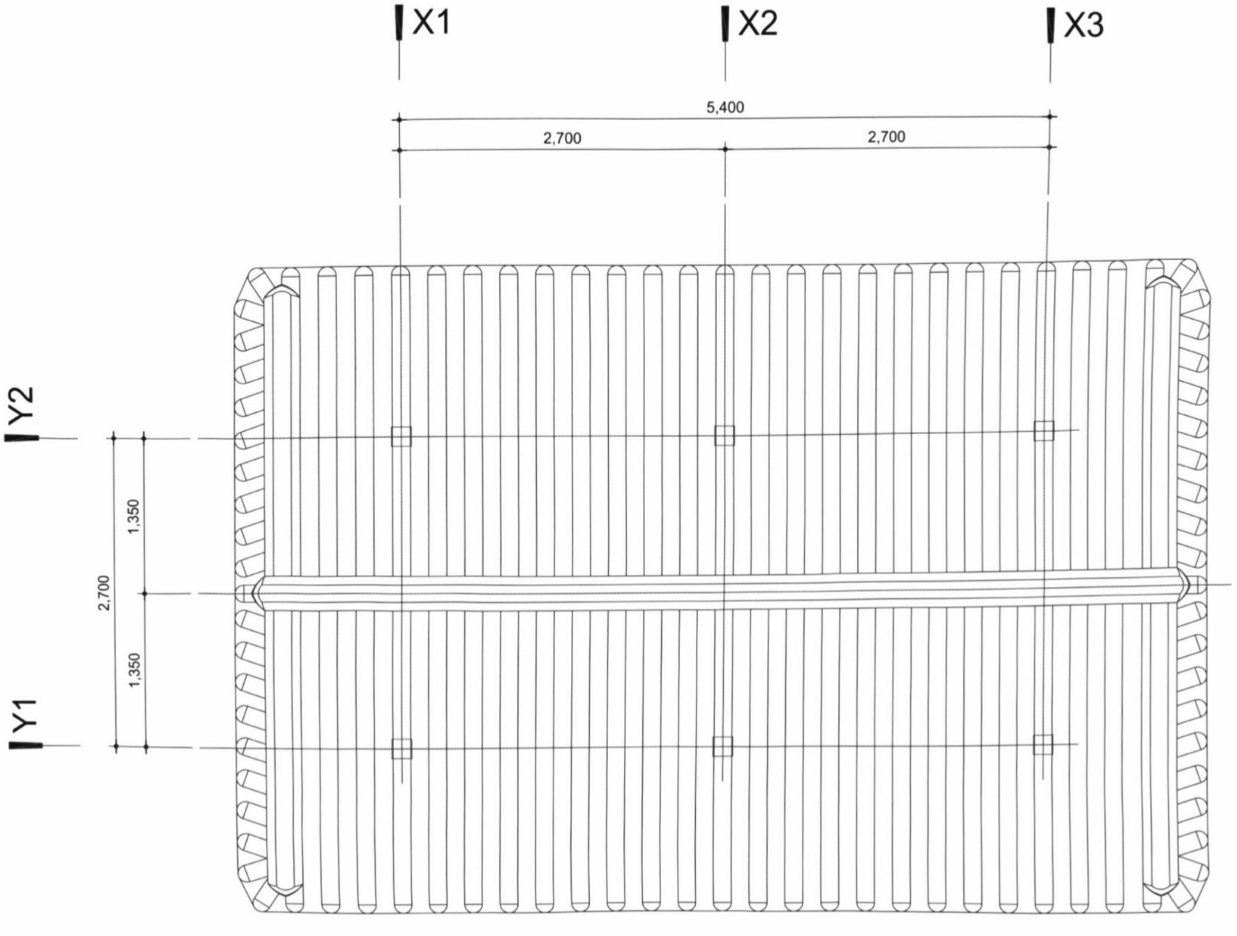
Hayujae_Plan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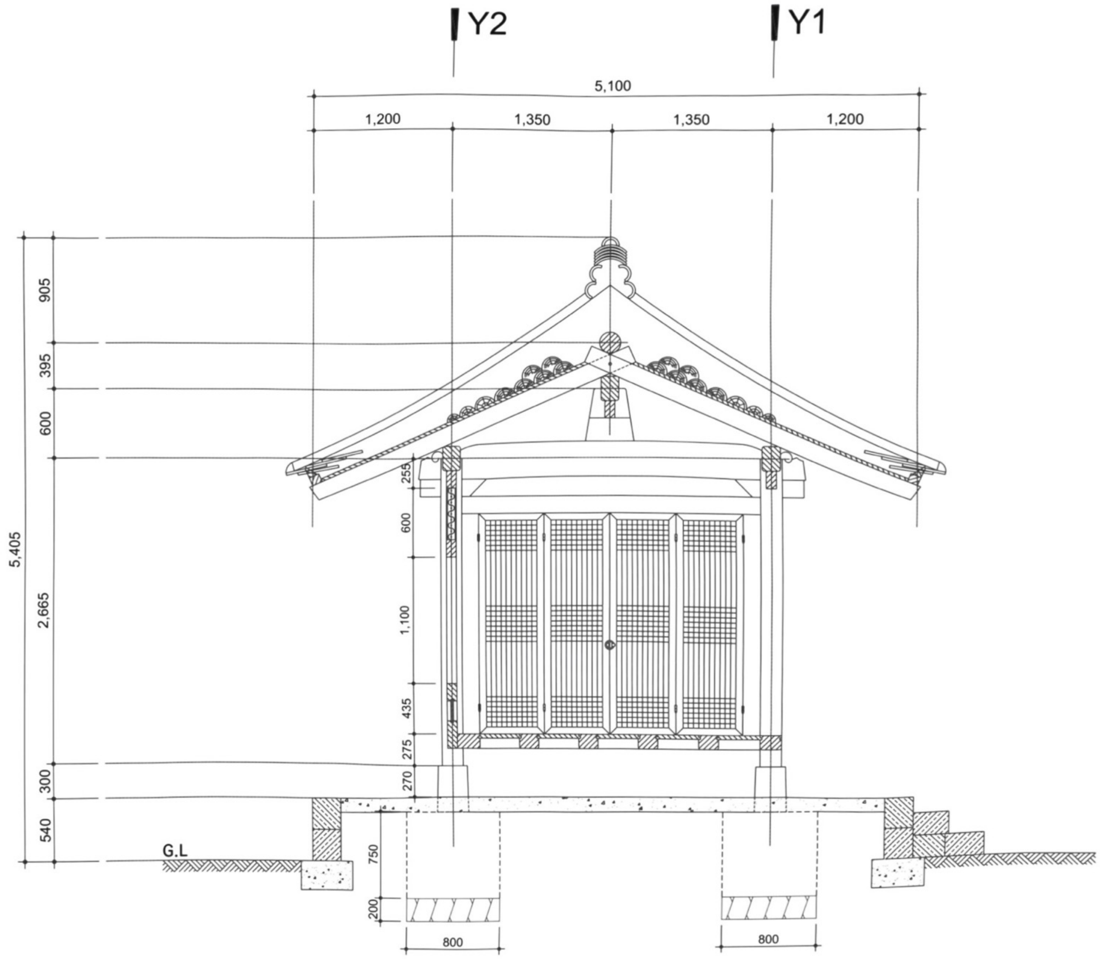
Hayujae_Roof Plan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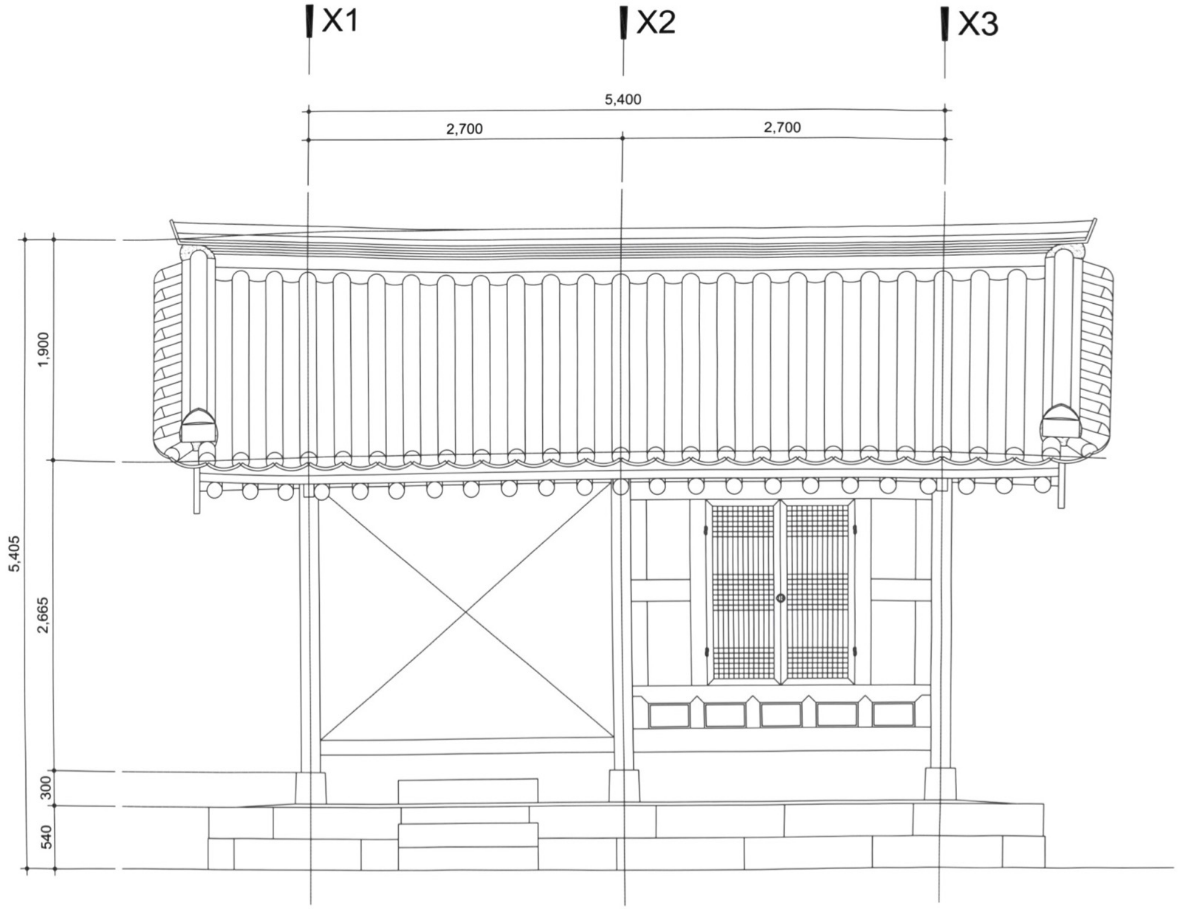
Hayujae_Section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Hayujae_Elevation

金蘭亭

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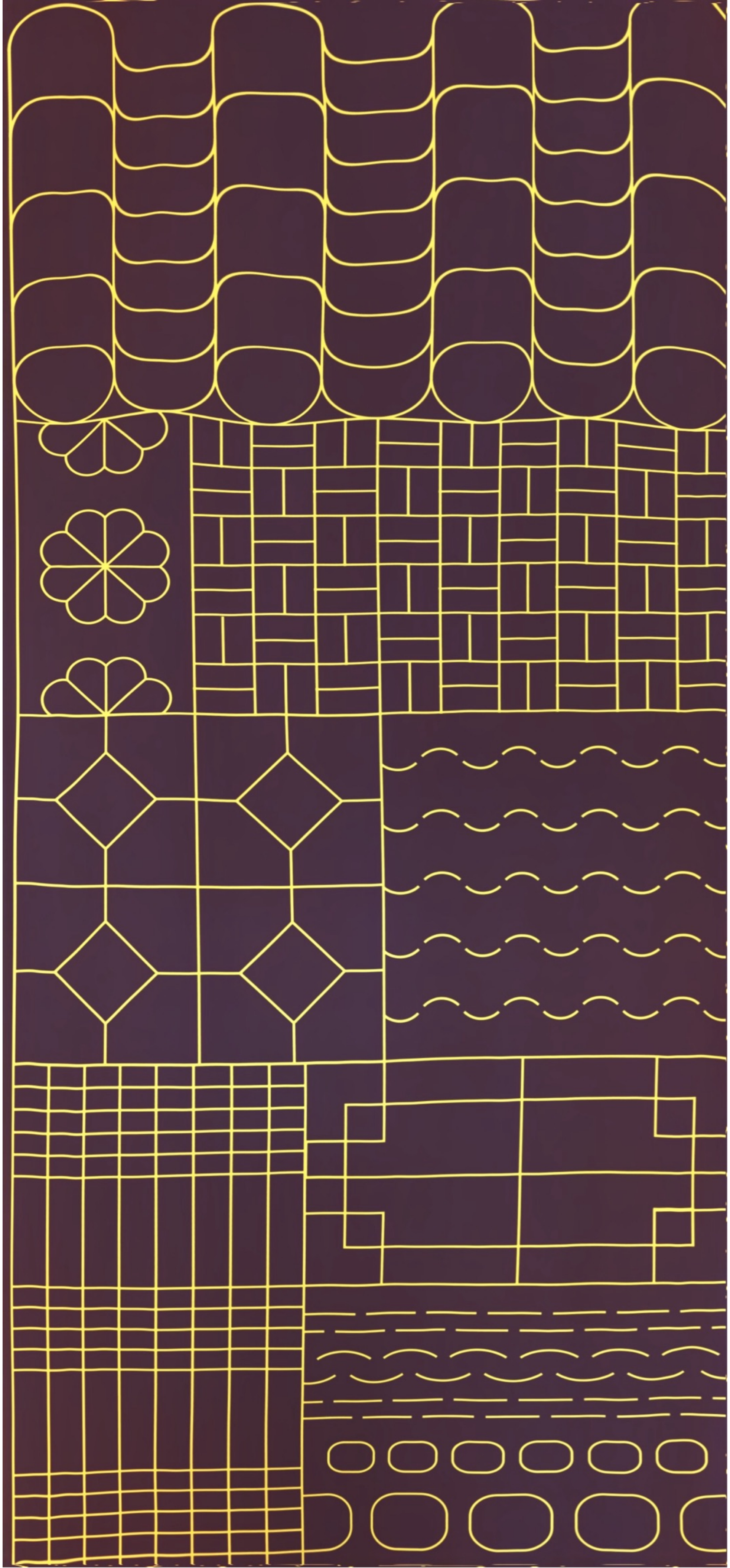
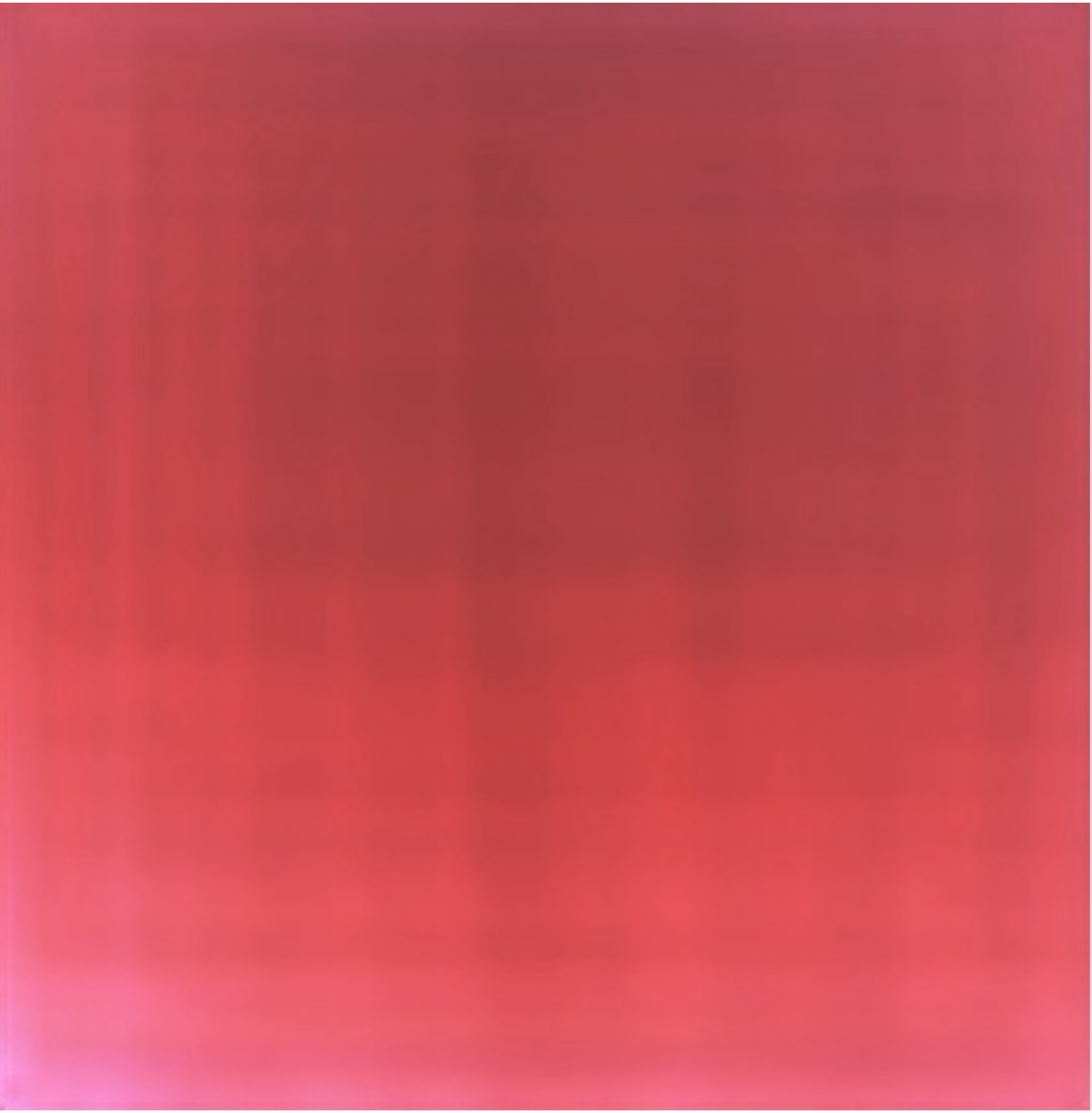


I

Building Hanok

1. Pre-construction Phase
2. Construction Phase



1. Pre-construction Phase

01 — Site selection

02 — Planning for construction

03 — Organizing Hanok experts

04 — Temporary construction

05 — Material, equipment, and tool

01

Site selection

1. Location and orientation

When selecting a site for the Hanok, an insight of the overall topography is important. According to 《*Taengniji(擇里志)*》, an ideal site would hold all 1) geographical, 2) economical, 3) neighborly, 4) scenic conditions in harmony.

According to 《*Sallimgyeongje(山林經濟)*》, an ideal site would have mountains in the back and water in the front. It is also said that if the site is spacious and has an auspicious shape, the dweller will maintain wealth, good luck, and virtue. The specific conditions of an ideal site are the following.

① The plot should be spacious, even, and have ample space on the sides.
② When located in valleys, the best plot is flatland slightly distant from the mountain foot.
③ It is best that the back of the plot is high, and the front is low so that the Hanok is open to the view. Spacious and flat land is also preferable. However, the following plots should be avoided: plots where the front is higher than the back, or where the center is lower than the surrounding area.
④ It is good to face east or south.
⑤ On a wide flatland, pick a site on even the slightest bulge.
⑥ The best is to have a moderate mountain in the back, and a pond in the front.

For modern architecture, the impression of the building from the outside is priority when selecting the site. On the other hand for the Hanok, the primary consideration in site selection is the viewpoint from the interior of the building towards the outside.

2. Practical considerations

After understanding the ideal standards, it is important to consider practical issues such as the following.

① The site should be approachable to the construction participants and construction vehicles such as trucks or excavators.

② The site should have an area to use as a workspace. A temporary warehouse to store the wooden components, a workspace for timberwork, and a space to pile up timber should be arranged in close distance to each other. If this space is where the front yard of the Hanok should be, it can be modified after construction and used as a yard.

③ Make sure that electricity and water are available. Power tools are needed at all times for timberwork, and water is needed for wet construction of the wall, roof, stylobate, etc. Therefore, it is best that a source of supply is situated nearby, but if not, temporary construction should be completed beforehand or a water supply truck and an electric generator should be prepared.

④ The focus of site selection is to look for the most ideal location that satisfies practical requirements as well as selected criterion.

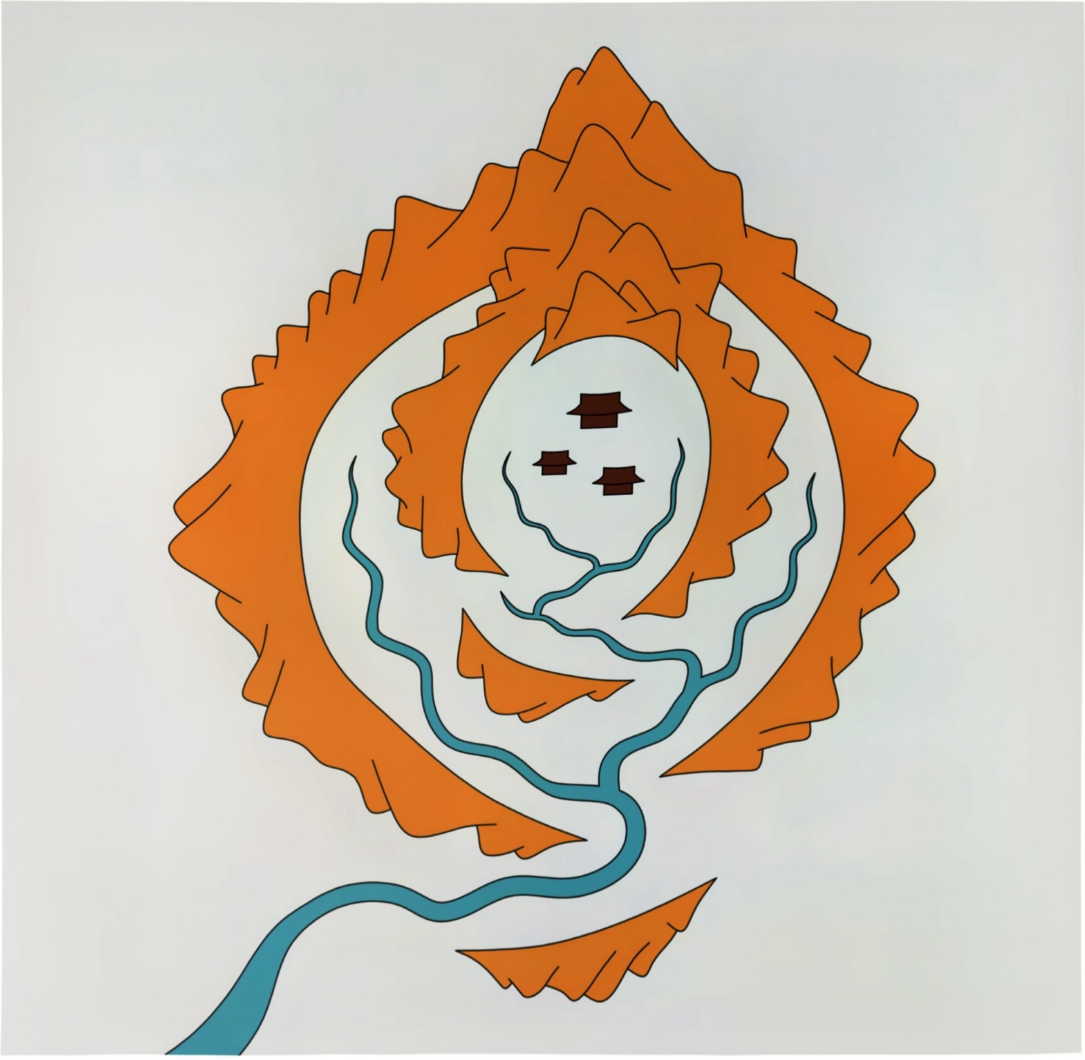


Diagram of an ideal site

02

Planning for construction

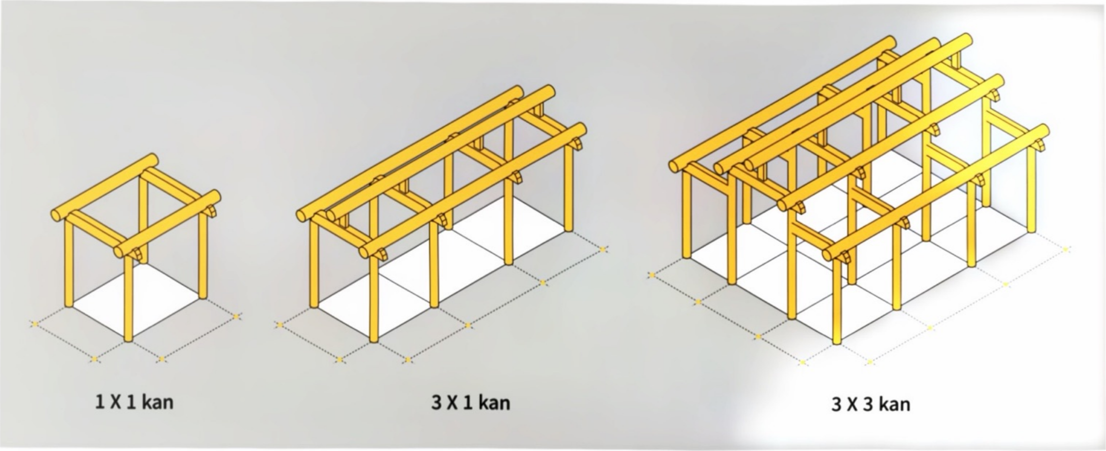
1. Planning

The blueprints of a Hanok include the floor plan, section plan, and elevation plan.
On the floor plan, decide the standard length of one kan, which is a unit bay of the Hanok, the number of kans, column thickness, flooring type, etc.
On the section plan, decide the joining method of the structural members.
On the elevation plan, map out the facade components such as walls and handrails.

1) Floor plan

❀ Bay(kan) length

On the floor plan, the distance between columns, in other words the length of one kan must be decided. Traditionally, the common length is 8ja (about 30㎝), but today, lengths can reach over 10ja depending on the type of wood.



Bay(kan)

Number of bays

Kan indicates either the length between two columns or the rectangular area surrounded by four columns. The number of kans is an important measure in deciding the size of the Hanok.

Column size

Once the size of the column is decided, the sizes of other building components can be decided respectively. Columns the size of 6~7chi(10chi=1ja) are commonly used.[1]

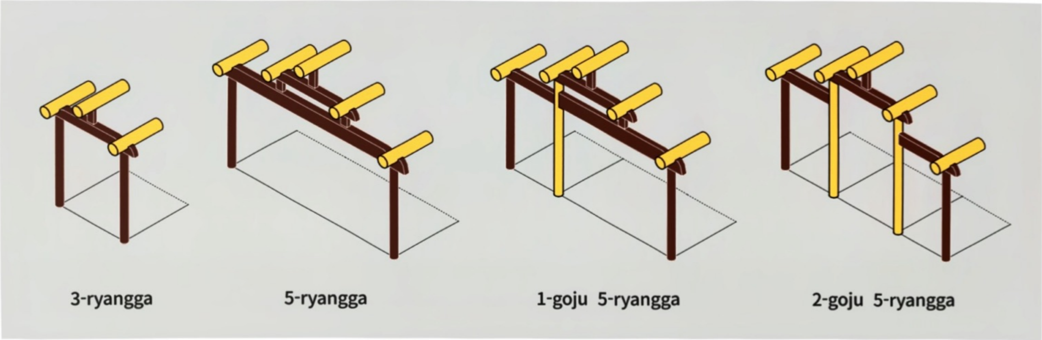
Flooring

It can be said that the flooring of each kan reflects the usage of the space. If wooden plates are tiled, the space is called Maru, and if flat stones[gudeuljang] are laid, the space is called Ondolbang.

2) Section plan

Purlin structure[ryangga]

Ryangga is a measure used in the section plan of the Hanok. Depending on the number of purlins[dori], the Hanok is named 3-ryangga, 5-ryangga, 7-ryangga, etc.



Purlin structure(ryangga)

Principal heights

The facade of the Hanok is largely separated into three parts: the foundation, body, and roof; the body part refers to the wall from the column base stone[choseok] up to right under the eaves, and the roof from the eaves end to the roof ridge[yongmaru]. It is important that the proportion of these parts are harmonious. This means in particular to decide on the height of a stylobate, a floor, purlins on column row[jusimdori], a top purlin[jongdori] and a roof ridge.

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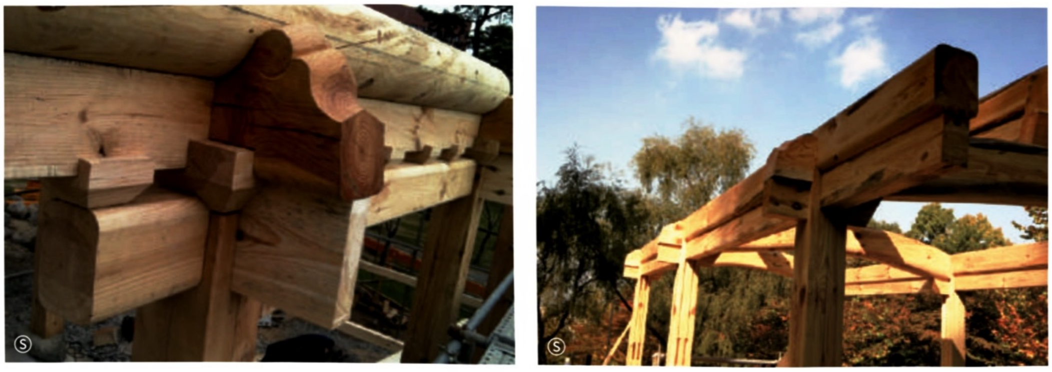
[1] Chi(寸), Jae(才)and Ja(尺) are the traditional measuring units. Chi is 3.0303㎝. Ja is 10 times Chi, which would be 30.30303㎝. Jae counts for the volume of timbers and is 3,240,000mm^3.

❀ Joining method of columns[gidung], beams[bo] and purlins[dori]

The two joining methods, mindori and sorosujang, are different in the components that are joined at the column head. Mindori is the most basic frame composition method of the Hanok which is column[gidung]-beam[bo]-purlin[dori]. On the other hand, sorosujang is a more formal structure that includes the connecting beam[changbang], capital[judu], and small bearing block[soro] additionally.



Joining method of columns, beams and purlins

3) Elevation plan

Kans that will be rooms should have walls, doors and lintels, while kans planned as Maru can be open spaces or have handrails or a backside wall.

2. Budgeting

The estimated budget for one kan from a small, simple type of Hanok is about 25,000,000 KRW(about 22,655 USD). The size of one kan varies; 8ja×9ja(about 2.4m×2.7m), 9ja×9ja(about 2.7m×2.7m), 8ja×12ja(about 2.4m×3.6m), etc, but in general, the area of one kan would be 6.5~8.5㎡, which is also about 2~2.5pyeong(平)[2]. The budget includes the material cost of the timber, roof tile, or stones as well as temporary construction cost, equipment rental cost and event cost for all sorts of ceremonies.

1) Material cost

A list of the required materials can be organized based on the item and quantity indicated on the blueprints. Materials are largely categorized into timber, doors and windows, stones, plaster materials, and aggregates. As in material cost, we are referring to the exclusive cost of the material. In other words, the expenses for transport, labor, and other supplies are assessed separately.

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[2] Pyeong is a Korean measuring unit for the area of the space. 1 pyeong is approximately 3.3m^2.

Timber

For Seoul National University's Hayujae, a two kan Hanok, the cost of timber was about 10,000,000 KRW (as of 2008, exclusive of surtax and transport cost). The timber were all general timber, Korean red pine under the size of 12ja. The measurement unit for timber in Hanoks is Jae(才). 1 jae means the timber size of 1chi×1chi×12ja, and the cost is calculated according to this unit.[3]

1jae = 1chi×1chi×12ja = 0.00334㎥
1㎥ = 299.5648jae (≒ 300jae)

In today's Hanok market, both Korean pinewood and foreign pinewood are used. The size of a residential Hanok is small enough that all components can be made from Korean pinewood. However, when longer components are needed, foreign pinewood is more affordable and easy to obtain. When using imported pine, make sure to select timber that is not noticeably disparate in texture and color.

Stone

Column base stone

For Seoul National University's Hayujae, rectangular granite stones finished with bush hammering were used for the column base stones and the stylobate(including the step stones). The cost of 6 column bases were 800,000 KRW(inclusive of surtax), and total 27m wide consisting the foundation, including the step stones, cost 4 million KRW(inclusive of surtax).

Most of the stones used in the Hanok are granite. Granite is white or light pink rock that has black specks and is mainly composed of quartz, feldspar, mica or amphibole. The advantage of using granite is that it can be processed in large masses, and is produced all around Korea.

Korean domestic granite has good quality and varies slightly in color depending on the produced area; from white, gray, to rose pink. Granites produced in Iksan, Hwangdeung region are bright grey and have finer crystals. Granites produced in Pocheon have larger crystals and a slight ivory color. Granites from Mungyeong have a pink tint. For Hanoks, granites

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[3] For the explanation of Korean traditional measuring units, see the footnote on page 27.

from the Pocheon area are mainly used. The standard cost of granites; purely the cost of material, is set as 216,000 KRW per 1㎥ and there is an additional finishing cost.

Today, stone components are cut with a large saw, forming a smooth surface. In order to reenact the rough surface of traditional stone components, post-processing is necessary. Post processing methods include the frosted finish, which coarsely removes unnecessary parts, the boasted finish, which uses a chisel pitching tool and a hammer to cut the stone along the grain, the bush hammered finish, which uses a bush hammer to smooth the surface and the dabbed finish which involves final polishing. However, the finishings above are handwork methods and require a considerable amount of time and cost. Only the bush hammering finish can be reenacted using machines. Therefore, the finishing cost of stones depends on how naturally the saw cut stones are finished, as if they were polished by hand.

❀ Roof tiles

For Seoul National University's Hayujae, the cost of roof tiles was about 4 million KRW(as of 2008, exclusive of surtax and transport cost), showing that the material cost for roof tile construction of one kan of a gabled roof[matbae-jibung] house is 2 million KRW.

<Roof tile requirement = requirement per unit area(㎡) × roof area> is the standard equation. The roof area here indicates the slanted area of the roof, not the horizontal plane of projection.

Roof tiles

Other special roof tiles can be counted on the blueprints. The size and price of roof tiles are standardized.

❀ Plastering work

For Seoul National University's Hayujae, the plastering material for 4 walls was 1 million KRW(including surtax) in total.

According to standard estimate, for construction starting from raising the vertical laths[o-eyeokgi] to wall plastering, the material cost is 40,515 KRW, and labor cost is 106,621 KRW per 1㎡ of the outer wall. Yet here the cost may increase depending on the quality of the material and the transport distance.

The plastering expense can be estimated by the area of the mud-plastered wall of the Hanok. In the case of traditional mud-plastered walls, material for the frame such as horizontal and vertical laths, straw ropes, and material for the mud wall, including red clay, soil cement, quicklime, and chaff should be prepared.

❀ Windows and doors

The production and installation of windows and doors have fixed costs per sheet. For instance for the latticed window/door which is commonly used, the material cost is 12,648 KRW and labor cost 413,620 KRW, which is 426,268 KRW in total for one sheet (450~900㎜ in length, 510~1,410㎜ in breadth, 45mm in thickness). Accordingly the total expense and volume of order is equal to the number of windows and doors. However the actual cost may change depending on the size and type of the door/window, the type of wood used, or the shape of lattices.

Windows and doors

2) Other costs

Costs besides the material cost include the following.

Labor cost

The wages for the master carpenter, carpenters, and other experts must be considered. Labor cost accounts for the largest portion of the total construction cost.

Temporary installation cost

Construction cost for the warehouse, rental cost for scaffolds(stationary or portable), and installation cost for water and electricity must be considered.

Equipment rental cost

The rental cost for equipment that are intermittently used should be considered. For instance, the forklift used for lifting heavy members, the multipurpose excavator used for excavating or moving aggregate, and the electric compactor used for foundation construction. Also a water wagon should be included if the supply of water is not sufficient.

Event cost

The table setting, food and other supplies for the various events should be prepared. Major ceremonies include the ground-breaking ceremony, timberwork ceremony, column erecting ceremony, framework completion ceremony, and the completion ceremony. However some events can be omitted or held at once.

03

Organizing Hanok experts

Various experts who participate in the Hanok construction are the following.

Hanok experts

1) Qualified Hanok architect

The Hanok architect should have the expertise in Hanok planning and a comprehensive understanding of Hanok construction. Inspection of the Hanok plan can be done by architecture firms that design Hanoks or firms specialized in construction of cultural heritages and listed by the Cultural Heritage Administration.

2) Expert in restoration of cultural heritages

These experts approved by the Cultural Heritage Administration participate in the restoration of cultural heritages. They can assist maintenance and overall control of the Hanok construction.

3) Master carpenter

The master carpenter is the head of all carpenters who plans and leads every operation of the woodwork: trimming and assembling the wooden members. Because woodwork is a major part of the Hanok construction, the master carpenter should have an overall understanding of the Hanok construction and have overall control.

4) Sub-master carpenter

These carpenters participate in the woodwork firsthand and handle their own part of the woodwork process.

5) Roof tile craftsman

The roof tile[giwa] expert specializes in laying roof tiles.

6) Door and window craftsman

The door and window craftsman, alongside furniture makers, is categorized as a trim carpenter. This craftsman is responsible for making the interior material or built-in furniture of the Hanok building.

7) Plastering craftsman

The plastering craftsman specializes in the plastering of mud or lime on the surface of walls, ceilings and floors. This expert is responsible for the plastering of the mud wall and the finishing work of the stylobate[gidan].

8) Stone craftsman

The stone craftsman specializes in carving and laying stones.

1 2 3
4 5

1 Door and window craftsman 2 Plastering craftsman 3 Stone craftsman
4 Master carpenter 5 Roof tile craftsman

04

Temporary construction

1. Temporary warehouse

A temporary warehouse is built to store timber and tools. It is also used as an indoor work space in case of rain. It should be large enough to store all the timber. A good storage place for wood should keep the wood away from direct light, yet be well-lighted, well ventilated and without moisture on the ground. When these conditions are not met, green moss may gather on the wood which makes it turn green, and in the worst case, timber may decompose. It is even hard to remove green moss either by washing or planing. Thus when used for the construction of the Hanok, it may negatively affect its appearance. The main usage of a temporary warehouse is timber storage. Therefore a good environment for storing timber should be arranged. In addition, one may choose a warehouse that has a lock to prevent theft or arson.

For Seoul National University's Hayujae, an enclosed warehouse the size of 52.65㎡(11.7m×4.5m) was built. Two doorways were kept for the passage of materials and people. For ventilation, gaps were kept between the floor, ceiling and the walls. Also entry doors were left open even on days without construction to allow air passage. Indoor lights and several outlets were installed on the walls for indoor work and to use power tools. Four fire extinguishers were placed to prevent fire. An enclosed warehouse has the advantages of safe storage, but at the same time it is hard

Enclosed temporary warehouse

Temporary workshop

to provide lighting and ventilation.

A tent warehouse is an alternative that provides ample ventilation and protection from rain. While an enclosed warehouse is safer to protect materials and tools from theft, when there is less concern of crime, a tent warehouse is better for wood storage and working. Aside from these options, a separate indoor workspace can be utilized. Transmissive work spaces such as the vinyl greenhouses can provide light while not being exposed to the outside conditions. Nonetheless indoor construction work accompanies noise and needs constant ventilation.

2. Open-air storage yard

An open-air storage yard is needed to store aggregates(soil cement, red clay, gravel, quicklime), stones(column base stone, stylobate stone), roof tiles, etc. The storage yard should be located near the Hanok site and provide convenient passage for transport vehicles. However, it should not affect the Hanok lot and workspace. Also, the storage yard should allow space to mix and allot aggregates with heavy equipments.

Storaging aggregates and stones

Storaging roof tiles

3. Temporary installation

1) Electrical installation

Electrical installation is needed to use power tools and to provide interior lighting. It is best to attain linear power supply from nearby, connect the power cable or split cords from the main outlet and lay copper wires underground. When it is difficult to attain power supply, a power generator can be used. When using only portable power tools, a generator of 6~7 kW will suffice but when using stationary power tools, a generator of at least 15kW is needed.

2) Water supply installation

Water supply is needed for wet construction work which includes construction work for the roof tiles, walls and stylobate plastering. In these constructions, water is mixed with aggregates. Generally, at a Hanok construction site, water supply facilities are installed beforehand, or a water pool is built on one side of the yard. If there is water supply nearby, water can be drawn with a hose, but if that is not the case, another option is to use a water supply truck.

05

Material, equipment, and tool

1. Material and Equipment

One can presume the material for building the Hanok from its blueprints. For the Hanok, individual members are joined to form a whole. Therefore, it is important to keep count of the exact number and type of different members.

1) Wood

The members used in the Hanok can be largely categorized into 1) thick, long members that make up the main structure(column, connecting beam[changbang], beam[bo], purlin[dori], purlin support[jangyeo], wooden floor[maru], lintel, jamb, etc), 2) flat, long members (rafter, lath on rafters, additional rafter, barge board, etc), and 3) components that have a shape along a curve (pantile supporting lath, angle rafter, short angle rafter, etc.)

The measurement unit for timber used in the Hanok is jae(才). 1jae is a 1chi×1chi×12ja size wood, and timber is priced by this unit.[4]

For a two kan Hanok that has 1 kan Maru, 1 kan Maru with a railing, about 3,300jae of timber is needed. Other than the components above-mentioned, wood needed for the following should also be considered: wood used as roof filling wood[jeoksim] that is piled under the roof, batter boards to set the location for the stylobate and column base, and the workbench for timber work.

It takes about one month to order the timber and have it delivered. The transported timber should be sorted according to usage and stored in the warehouse to prevent contamination and damage. If the timber has to be stored outdoors, cover with a tarp or install a tent to protect the timber from the rain. On occasions, processed timber is plastered with traditional Korean paper[hanji] or filling clay, or glue is applied to the ends to prevent the timber from splitting. Also the timber is piled on a saw buck so that it does not directly touch the ground. A saw buck can be made with thick timber or pallets can be bought from the store. Once the saw buck is ready, pile the timber according to the order they will be dressed; the ones that are dressed the last would be stored from the inside.

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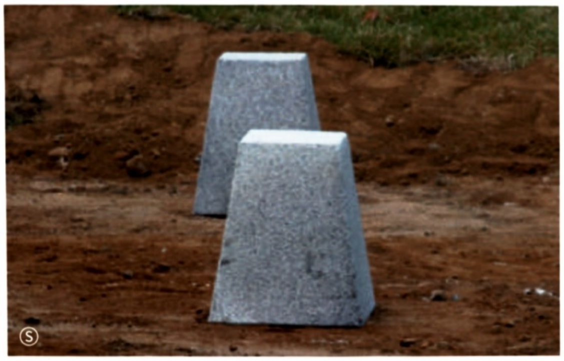
[4] For the explanation of Korean traditional measuring units, see the footnote on page 27.

Transported timbers

Storing timbers on a saw buck

2) Stone

Stone is needed for the stylobate stone, step stone and column base stone. Usually granites widely produced in Korea are used. The number of step stones equals the number of columns, and the number of stylobate stones is calculated by the total length of the stylobate. The number of step stones depends on the number of kans of the Maru and placement of steps. Fabricated stone purchased from a factory can be immediately installed on site because the cutting and finishing is already complete. On the other hand, when using natural stones, a fixed price for the stone does not exist, so one must be careful when purchasing.



Column base stone

Lifting and carrying stylobate stone

3) Aggregate

Various types of aggregate are used in the Hanok. For the foundation and stylobate construction, gravels, soil cement, and sand are alternately used or mixed. For the wall and roof construction, a mixture of mud and soil cement is used. Aggregates are always used with quick lime. When combined with water, quick lime becomes slack lime through chemical transition and can be used like cement.

4) Wall-plastering materials

Other than aggregates, plastering the walls involves raising lattices[oeyeokkgi] and applying fodder. Fodder, mostly chopped straw, is combined with mud to mud-plaster the walls. The fodder prevents the mud wall from splitting and makes it more adhesive. For raising the lattices[oeyeokkgi], horizontal and vertical laths and straw ropes are used. The horizontal laths are set as the skeleton; the vertical laths are placed criss-crossing the horizontal laths and tied with the straw ropes. After this, one can start with the mud-plastering.

Fodder(chopped straw)

Laths

5) Roof tiles

Purchase roof tiles that are manufactured according to the KS standard. Normally, three layers of flat roof tiles are laid, round roof tiles are placed on top and finally roof tiles for the ridge of a roof[maru] are laid. Here the roof filling wood[jeoksim], which creates the base for the roof tile curve and the filling earth should be prepared. Here it is convenient to purchase the wood for the roof filling wood together with the other timber.

6) Scaffold

❀ Stationary Scaffold

Set up stationary scaffolds on every side of the site that will stay up for the whole construction period. Although more costly than portable scaffolds, stationary scaffolds make stable workbenches and are safer. So many people can work on stationary scaffolds at once. However it may be inconvenient that the stylobate construction cannot be started while the stationary scaffolds are present and workers must always pass through the installations.

❀ Portable Scaffold

Portable scaffolds serve as secure workbenches at appropriate heights for construction on the Hanok ceiling and roof. It is also useful when assembling members for the roof construction and plastering construction. Therefore, it should be prepared during the assembly stage.

7) Heavy equipment

Heavy, expensive equipments may be needed in the Hanok construction. Since such equip-

Stationary Scaffold

Stationary Scaffold

ments are not always needed, they should be prepared when necessary. When using the stationary plane and generator, finishing of the board surfaces(shingle, barge board, floor board, etc.) can be easily done.

Compactor or rammer

These equipment can be used for compacting the individual footing during the foundation construction. Traditionally this would be done with a manual compactor which needs manpower, but the compactor can finish the same job easily in a quarter of a day.

Jack

The jack is a tool to manually lift heavy members, but it can also be used to support members at a certain height such as the wall frames and Maru frames.

Water wagon

The water wagon provides water for wet construction. However, if water can be supplied from nearby, a water wagon is not necessary.

Forklift

A forklift is useful when alighting, loading and moving members. Especially members of great volume such as timber or heavy components like column bases and roof tiles can be easily transported using a forklift. The forklift may be considered inefficient because the amount of work it does at one time is insignificant, but it is still important because it significantly reduces manual labor.

Multipurpose excavator

The multipurpose excavator can be used in various ways, including excavating, flattening the ground, and moving components. It is useful when excavating the independent footing, stacking the stylobate, and moving the column base stone or stylobate stone.

8) Portable power tools

Using only manual tools for the Hanok construction would be too time consuming. Various portable power tools(chain saw, wheel saw, planer, electronic chisel, electric driver) enhance the speed and accuracy of construction.

9) Other supplies

Other necessary supplies include the following.

❀ Long nails, nails

When assembling the rafters, the long nails are used to pierce the rafter and connect it with the purlin[dori] (length: 7chi~1ja, 21~30㎝). For every rafter, three long nails are needed. Nails are used to fix the shingle[gaepan] to the rafter, for every shingle 6 nails are needed. Nails are also used to attach the barge board[bakgong].

❀ Tarp

A tarp is needed to protect the material and Hanok from rain. Before tiling the roof, the wooden members of the Hanok are exposed to weather. Moreover the members stored outside of the temporary warehouse should be covered from rain. Because the members used in the Hanok construction are mostly dried, it is best that they are exposed to fresh air while proper covering is necessary in case of rain.

2. Tool instructions

As time passes, Hanok carpenters also increasingly use gear tools.

Hand tools

1) Measurement/Ink marking tools

Different measuring tools are used for each of building process, but it is important to make sure that the same measurement unit is used in every situation. The tools that are used for measuring and ink marking for trimming are as follows.

Carpenter's square

Gauge rod

The carpenter's square is made of stainless steel. On the front of the angle-shape ruler, there are gradations by ja(尺), chi(寸), pun(分), and ri(釐); on the back, the measurement of circular diameter and diagonal length is given.

The proper way to use the carpenter's square is to grab the 1/3 point(center of weight), or middle of the longer side, and mark with ink against the shorter side. By placing the angle on components, one can also check a right angle.

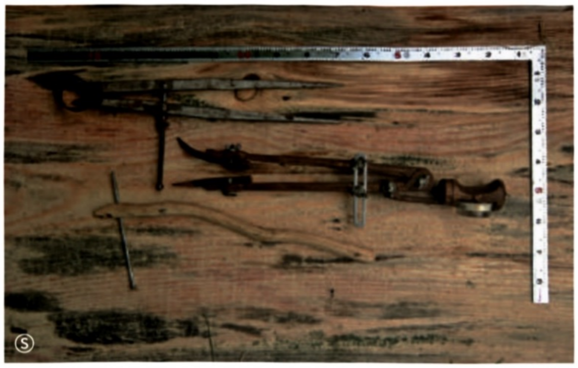
Gauge rod

The gauge rod is the standard ruler fixed as standard at each construction site, and is shared by all the participants. Two rules for using this guage rod include: Leave about 5 pun from both sides of a long rectangular timber and mark the ja unit, and indicate the measurements of principal members that are to be processed. Use it as a standard when handling members. For the gauge rod to last a long time, use straight grain timber that is well dried and without knots or distortion.

Tape measure

A tape measure is a narrow metal or fabric strip marked with gradations and coiled in a round container. The strip is unwinded to use for measuring. The two commonly used types are 5m or 7.5m of length. It is useful to have a tape measure that has both meter and ja gradations.

Marker for geurejil


Marker for geurejil

The marker for fitting two components for connection[geurejil] is a type of compass. It is used to make a precise trace marks for the trimming of members to be fitted together tightly without any gaps. Accordingly it is used to mark a column that will be raised on the foundation stone or a wall frame to be joined into structural members. There is not a separate tool for this purpose, so one may use any tool that can mark lines at regular intervals.

❀ Ink well and ink pencil

An inkwell stores ink that is used to soak strings to mark with ink. Cotton or fabric is dipped in the ink well so that the ink pencil can be dipped in, and the ink strings are always soaked in ink. A point is tied to the end of the ink string so that it can be fixed onto the end of the member to be marked. After fixing the point, unwind the ink string and move to the exact point at other side while holding the string tightly. Flick the string and mark with ink. It takes practice to flick the ink string in a straight line.

The ink pencil is also called the carpenters pencil and is made by carving bamboo. The ink pencil is needed because it is difficult to mark on a round column or bumpy wood with a normal pencil. It is made by sharpening one side of a sliced bamboo stick and flattening the round bark. Then mark with ink by dipping the pencil in a the ink well. It can also be used to write letters if one cuts the opposite side to be a spike shape and pounds with a hammer to make soft.

❀ Plumb bob and level

The plumb bob has a weight suspended on a string to check if a component is perpendicular to the ground. The level is used to match the height of two distant components or to check the horizontality of a component. A water level is used when the two components are too far away from each other. It is an instrument that involves air pressure. It levels components by using the fact that when the two ends of a water hose are set up vertically, the water level of the two ends are the same. On the other hand, when testing the smoothness of individual components, manufactured levels can be used.

Plumb bob and level

Plumbing

2) Hand tools for timber work

❀ Plane

The plane is used to evenly smooth, finish, or add certain details to trimmed members. Depending on the different shapes, various types of planes are used. In the past, planes were made to be pushed forward, but today Japanese planes which should be pulled toward the body are commonly used. A pulling plane is better to execute detailed work. When planing, it is important to move a long length, with uniform strength, at a high speed. An electronic plane is used on the construction site for efficiency, but finishing is done with a hand plane to polish the surface. The plane blade should be sharpened if it is rugged. Sharpen the blade on a whetstone, and let the end sides of the blade be a bit blunt. If the edges are sharp like a chisel, plane marks can be left on the wood. When assembling the plane, make sure that light does not come through when the back iron and plane blade are overlapped.

Plane

❀ Chisel

A chisel is used to drill a hole or carve joints. It has two ends with different shapes; the flat end is used to carve out vertically and the slanted end is to carve out an even bottom from a slanted surface. While the handle and blade of the traditional chisel are fixed together, the handle and blade of the modern chisel are separable. Sharpen the chisel blade thoroughly on a whetstone but make sure that the end sides are sharp. This is to have the chisel edges carve the wood sharply at an exact width.

Chisel

❀ Mallet, hammer

The mallet is a big hammer made of wood and is a tool to hammer wooden members in assembly without damaging them. When joining large members, several people hammer at the same beat. The hammer is a tool to drive in nails.

3) Power tools for timber work

❀ Chain saw

With the chain saw it is hard to do detailed work. However because it is fast and strong, it is used to create the general shape or cut excess parts in the early stage.

❀ Wheel saw

It is better to use a wheel saw than a chain saw to cut straightly. It is used to cut floor boards or tenons straightly along the ink mark. Also the vertical angle of the blade is adjustable, so it is appropriate for cutting slanted planes like dovetail tenons.

Because the depth of the blade is adjustable, it can be used for prior chiseling works of members that have measured depths, such as mortises. There are blades with various diameters for the wheel saw, so one can choose the size of the saw depending on the size of the member that is to be cut.

❀ Electronic plane

The plane is one of the most used tools because the surfaces of all members must be smoothed. Therefore, an electronic plane is used instead of a hand plane generally on the construction site. When using an electronic plane, make sure that the head is always touching the component so that the blade does not shoot out. Also, to stop, lift the rear slightly so that the wooden member is not dented.

❀ Electronic grinder

An electronic grinder is used to sand and finish the surface of components. It is used to eliminate marks from planing or misaligned joints after the Hanok has been assembled. The width of the sanding belt can be adjusted according to need.

❀ Electronic angle chisel

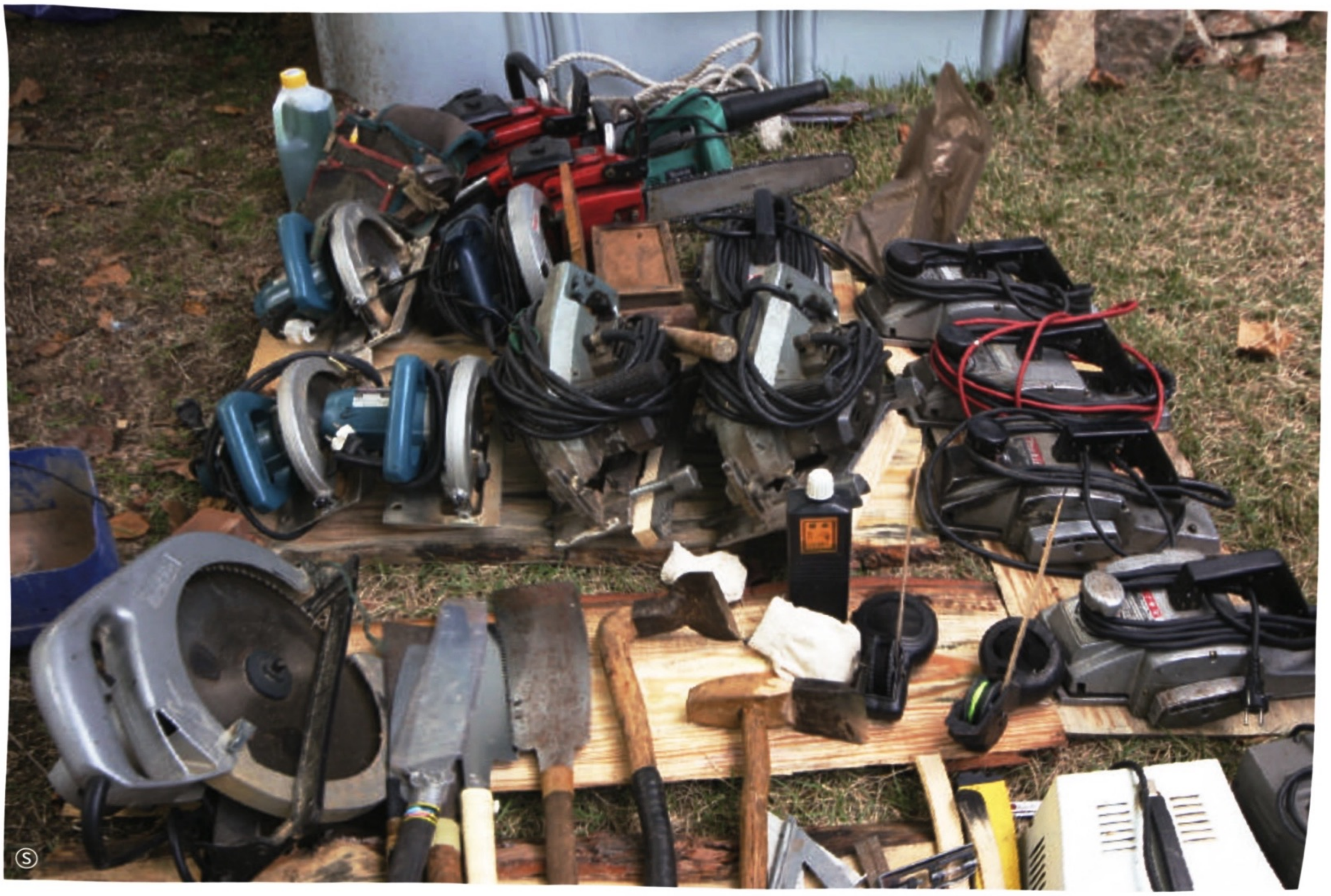
The electronic angle chisel is a tool that can carve mortises electronically. Instead of using a chisel and hammer, it can easily carve unit squares to the certain depth with a drill cutter. Mortises can be completed easily by repeatedly carving out squares to fit the needed length.

❀ Electronic plow plane

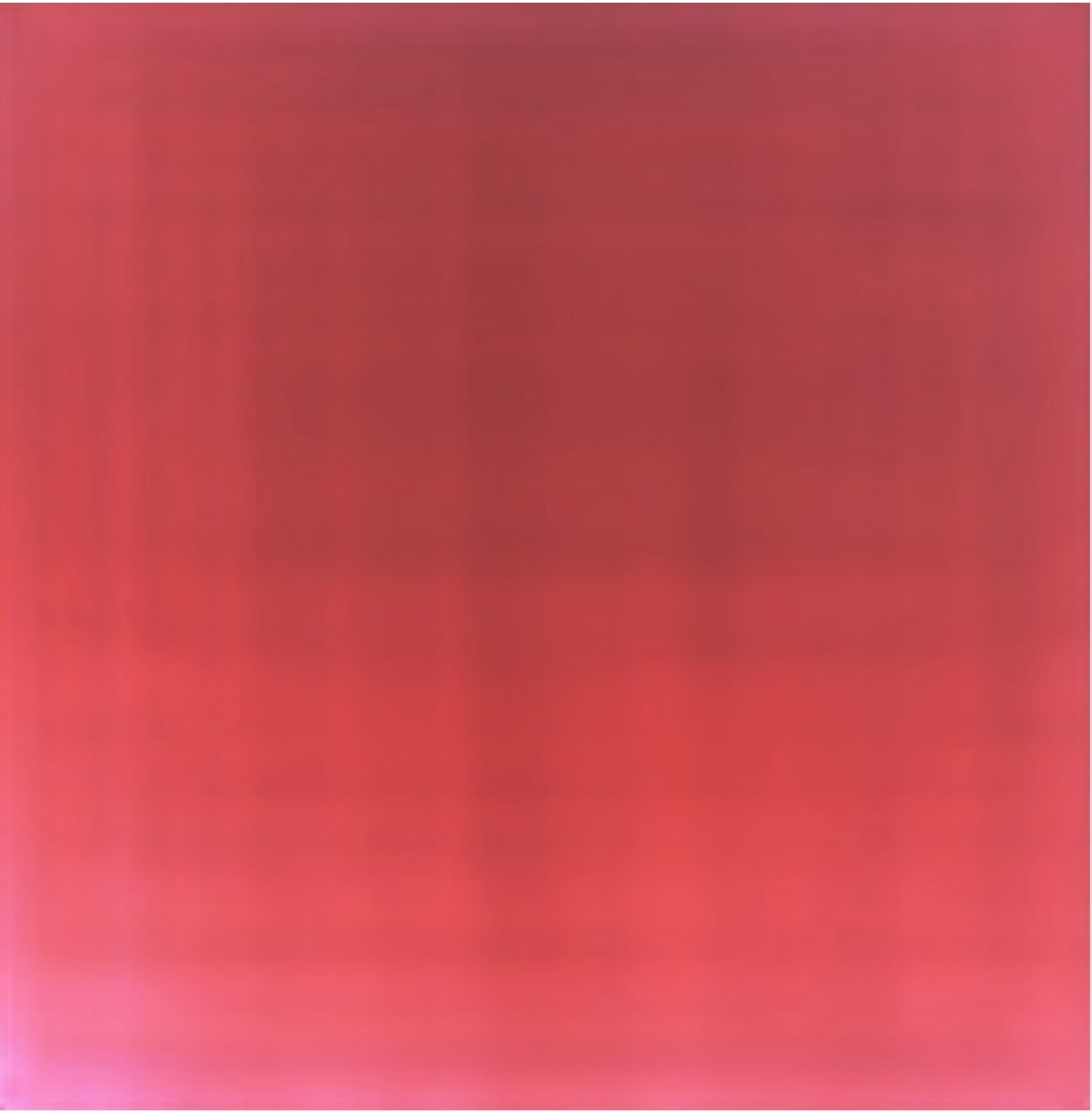
The electronic plow plane carves longitudinal grooves of the component and replaces the manual plow planer. It is used to carve grooves of the jamb where mud is filled in, or grooves on the laths on rafters[pyeonggodae] where the shingles[gaepan] are inserted. When using an electronic planer, it is easier to carve grooves that are of consistent thickness and depth.

❀ Beveling machine

The beveling machine roundly chamfers the edges of the members and substitutes the plane. It is effective to use a gear tool to create regular shapes when dressing the dull timber edges into curves. The shape of chamfering can be chosen according to the beveling blade.



Power tools for timber work



2. Construction Phase

06 — Ground-breaking ceremony

07 — Preparation for timberwork,
Timberwork starting ceremony

08 — Building the foundation

09 — Laying column base stones

10 — Timberwork I : structural frame

11 — Timberwork II : roof structure

12 — Column erecting

13 — Structural frame assembling

14 — Framework completion ceremony

15 — Roof structure assembling

16 — Roof tiling

17 — Wall frame construction

18 — Maru construction

19 — Wall construction

20 — Railing construction

21 — Door and window installation

22 — Stylobate construction

23 — Oil coating

24 — Cleaning

25 — Completion ceremony

06

Ground-breaking ceremony

Ground-breaking ceremony[gaetoje]

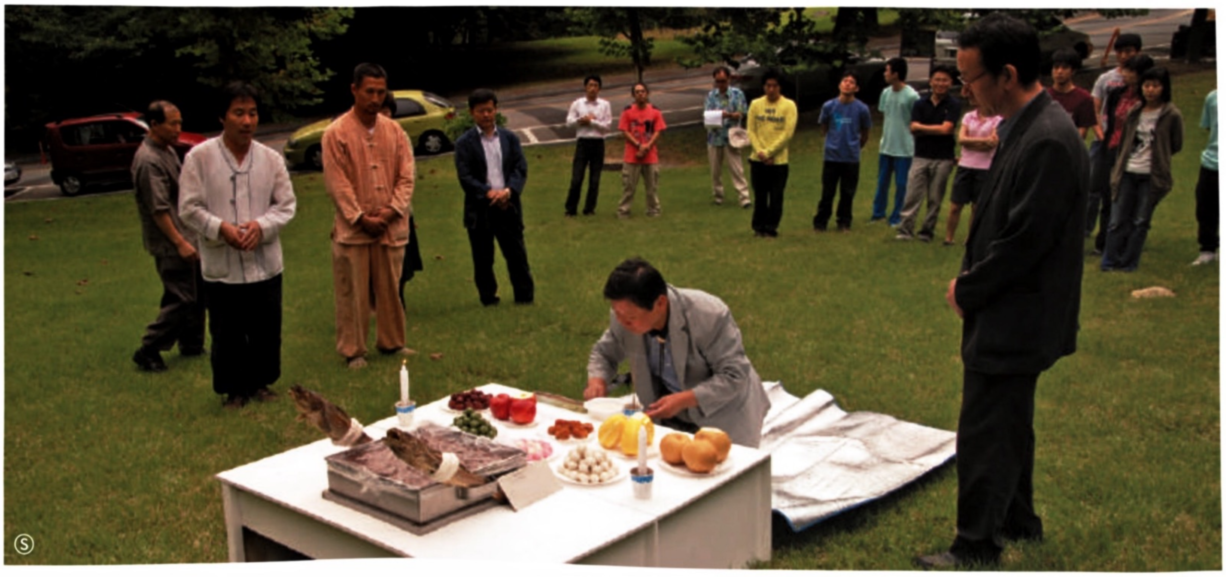
At the start of construction, a ground-breaking ceremony is held. On the one hand, it is a ceremony to tell the gods and earth that construction has started and wish for everything to proceed safe and sound. On the other hand, it is to ask neighbors for understanding inconveniences due to construction. However the prime purpose of the ceremony is for the owner, soon to be a dweller, to meet the construction participants and neighbors.

The ceremony is held where the columns are to be placed at the center of the Hanok site.

Food for ancestral rites is prepared, and the ceremony is held to the appointed procedure.

Starting with the master carpenter and volunteers, everyone participates in the ceremony and bows one by one.

If the timber is to be brought in on the same day, the timberwork starting ceremony [motang-gosa] can also be held at the same time.



07

Preparation for timberwork, Timberwork starting ceremony

1. Preparation for timberwork

Bringing in and storing timber

Alight the timber onto the forklift from the truck.

Check the list of articles. Arrange the location and order to store the members and transport the timber to the warehouse.

Pallet block[motang] should be placed properly when storing timber.

2. Timberwork starting ceremony[motang-gosa]

Timberwork starting ceremony

A motang is a wooden block that props the timber to be chopped. The word itself also has the meaning of background or basis. Accordingly the timberwork starting ceremony is a ritual for preparation. The ceremony is to tell the gods that carpenters have started timberwork; at the same time, this helds a spiritual meaning for the participants. They settle their minds and wish for everything to proceed safe and sound. It holds the wish to store and trim important wooden members safely and thus complete a sturdy Hanok.

The procedures are same as the ground-breaking ceremony.

08

Building the foundation

Digging and reinforcing the foundation where the Hanok is to be built.

Work procedure

With a multi purpose excavator, remove the topsoil and level the ground.

Check the location of column base stones and place batter boards. Crude batter boards will suffice since they can be damaged in the excavation process.

Excavate trenches around the column base stone: a size of 1m×1m and 1m deep. Tracing can be done by sprinkling lime powder using a 1m×1m wooden frame.

Traditional footings involve rectangular stones, rubble, quicklime and sand footing etc. Among these, rubbles are used most often.

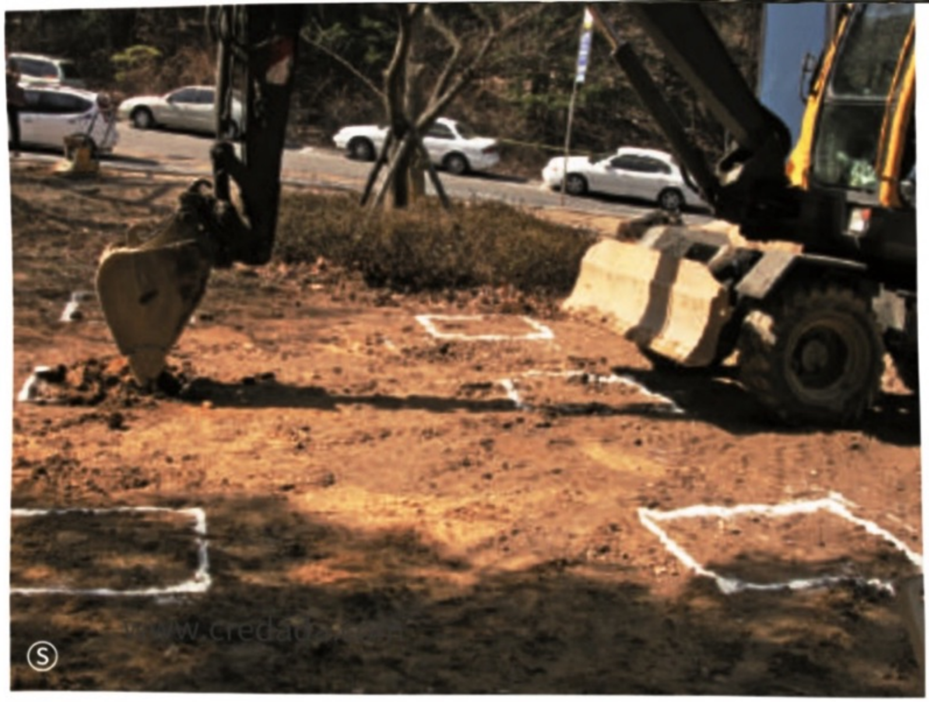
With a multi purpose excavator, repeat the compacting process of spreading out rubbles, pouring the mixture of quicklime and sandy soil(soil cement, white clay) and compacting. Use a compactor or a rammer.

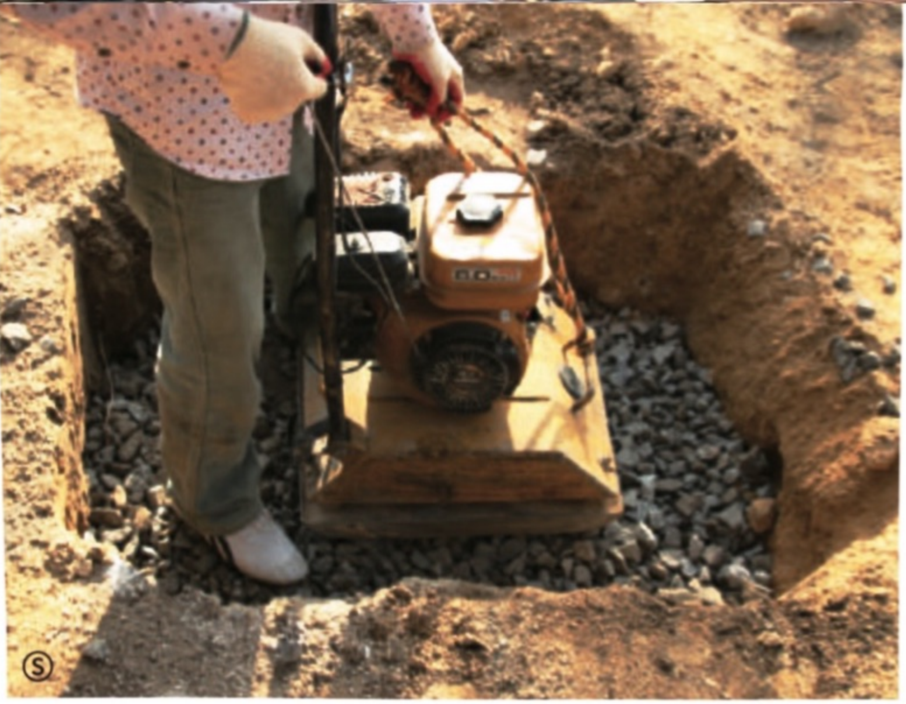
The concrete foundation is made with a mixture of cement, sand and rubble.

Pour the concrete mixture into a form that has been made beforehand. Remove the form after curing and finish with backfilling.

The pile is constructed to its maximum height, considering the height of the platform and the depth of the column base stone.

It takes time for the quicklime footing to harden. After 4~5 weeks, the foundation will be stable enough to lay the column base stones and raise the columns.





1 2 — 1 Excavating trenches 2 Compacting
3 4 3 Compacting 4 Quicklime foundation

09

Laying column base stones

After the footing work, column base stones[choseok] are laid.

1. Placing batter boards

Batter boards are placed to mark the planar position and vertical height of column base stones. Check that the posts are standing at the same height using a water level. Then connect the posts with a furring strip to complete the installation of batter boards. The top edge of the furring strip indicates the column base stone's top edge.

Placing batter boards

Using a water level

2. Suspending strings

After approximately placing the base stones, connect the furring strips that are facing each other with strings.

It is important to suspend the strings so that they cross at a right angle. Normally a rectangular

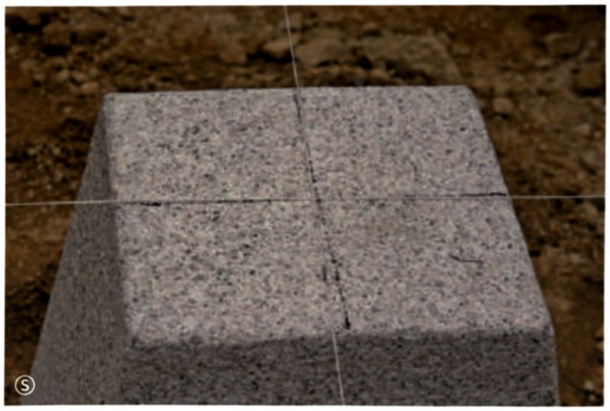
plywood is used for this process, or one can apply Pythagoras' theorem. Use either the right triangle of 3m:4m:5m or 6m:8m:10m and check with a gauge rod.
Adjust the suspended strings to form an exact right angle.

1 2 | Suspending strings

3. Laying column base stones

Mark the center of column base stone with ink and use it as a reference point for the strings. When using processed column base stones, first mark the center of the stone with ink, and then align through the strings. Since column base stones are rectangular shapes, they should be placed in the correct orientation.
Because processed column base stones are uniform in height, prop them up with aggregates or dig the ground to have them meet with the strings as closely as possible. When the stones stand at the same height, it is easier to raise the columns later on.
When using natural stones, fix the column base stone and then mark the center of the stones with ink according to the string. This is possible because there is no fixed direction for natural column base stones. Yet, it is still important to level the heights of the stones so that it is easier when fitting for connection[geurejil].

Laying the column base stone in the correct orientation



Marking the center of column base stone

10

Timberwork I
: structural frame

1. Column[gidung], beam support[boaji], and purlin support[jangyeo]

1) Column

The column is a principal load carrying member that transfers the load from the roof to the column base stone.

When placing the timbers on the workbench, carefully consider the bending direction and top or bottom of them.

Cut the timber, yet leaving extra length for fitting for connection[geurejil]. Mark the necessary parts and plane the surface.

After cutting and planing, mark the center point as reference for assembling the columns afterwards.

Set the side with fewer cracks and knobs as the front side and mark on the end. Depending on the joining method(mindori, sorosujang)[5] and the presence of a lintel, mark an ink line for the mortise(cross joint, lintel mortise) and dress the timber. If walls are planned, carve a long mortise to align the jambs. When the timberwork is finished, mark on the carpenter's construction drawing[dohaengpan] and the end of the column, then store the timbers in the storage.

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[5] Mindori-style is a housing type without brackets or purlin supports and rectangular purlins are used. Sorosujang-style is a housing type in which small bearing blocks are additionally placed under the beams or the timber strips supporting the beams.

1 2 — 1 Placing the timbers on the workbench 2 Sawing joint
3 4 3 Carving mortises 4 Carving a groove on wall stud

2) Beam support[boaji]

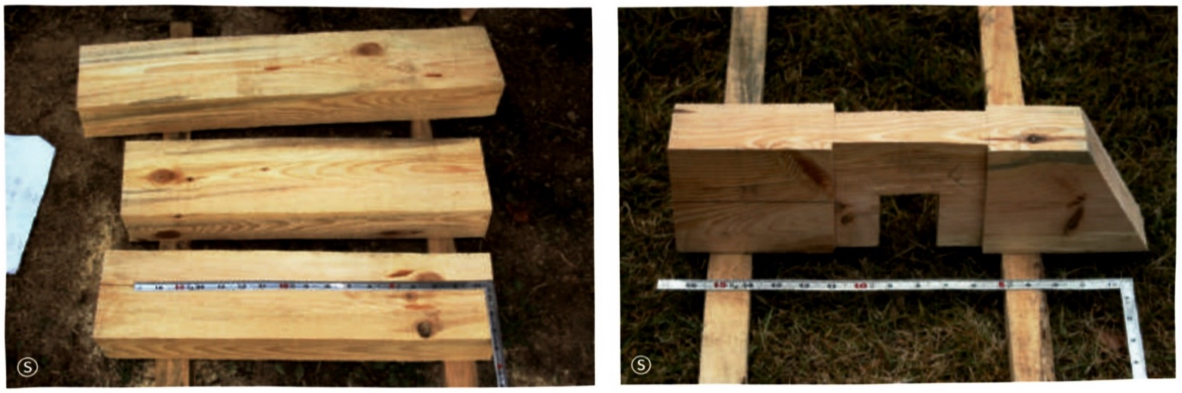
The beam support is a small member that supports the beam. Every column is capped with one beam support.

Preferably have the concave side of the timber face up so that it supports the main beam [daedeulbo].

Mark with ink, plane, and cut.

Mark the center with ink as a reference for assembly.

In the case of house type without bracket set[mindori], the beam is placed without a capital [judu] so the topside of the beam supports is flat. With the house type decorated with small bearing blocks[sorosujang], however, the part joining with the capital should also be dressed. When the timberwork is finished, mark on the carpenter's blueprint and topside center of the beam supports, and then store the timber.



1 2 | Beam supports

3) Purlin support[jangyeo]

The purlin support is a member that supports the purlin[dori]. With the house type without bracket set, it does not directly cap the column head, but with the house type decorated with small bearing blocks, it caps the capital. For a 3-ryangga, 3 purlin supports in total(two purlin supports on column row[jusimjangyeo] and one top purlin support[jongjangyeo]) are required for every bay. Have the convex side of the connecting beam[changbang] face up, the bottom end head outwards the building and set on the workbench.

Mark with ink, plane, and cut. Cut along the ink line, but leave extra length for fitting for connection. When the timber is cut to its shape, mark the center and refer to it when assembling.

Set the side with fewer cracks and knots as the front side for aesthetical purposes and mark this side on the end of the member. Mark with ink and dress according to the joining method(mindori-style, sorosujang-style). When the timberwork is done, mark on the carpenter's blueprint and store the timber.

1 2 | Beam supports

2. Capital[judu], small bearing block[soro], and connecting beam[changbang]

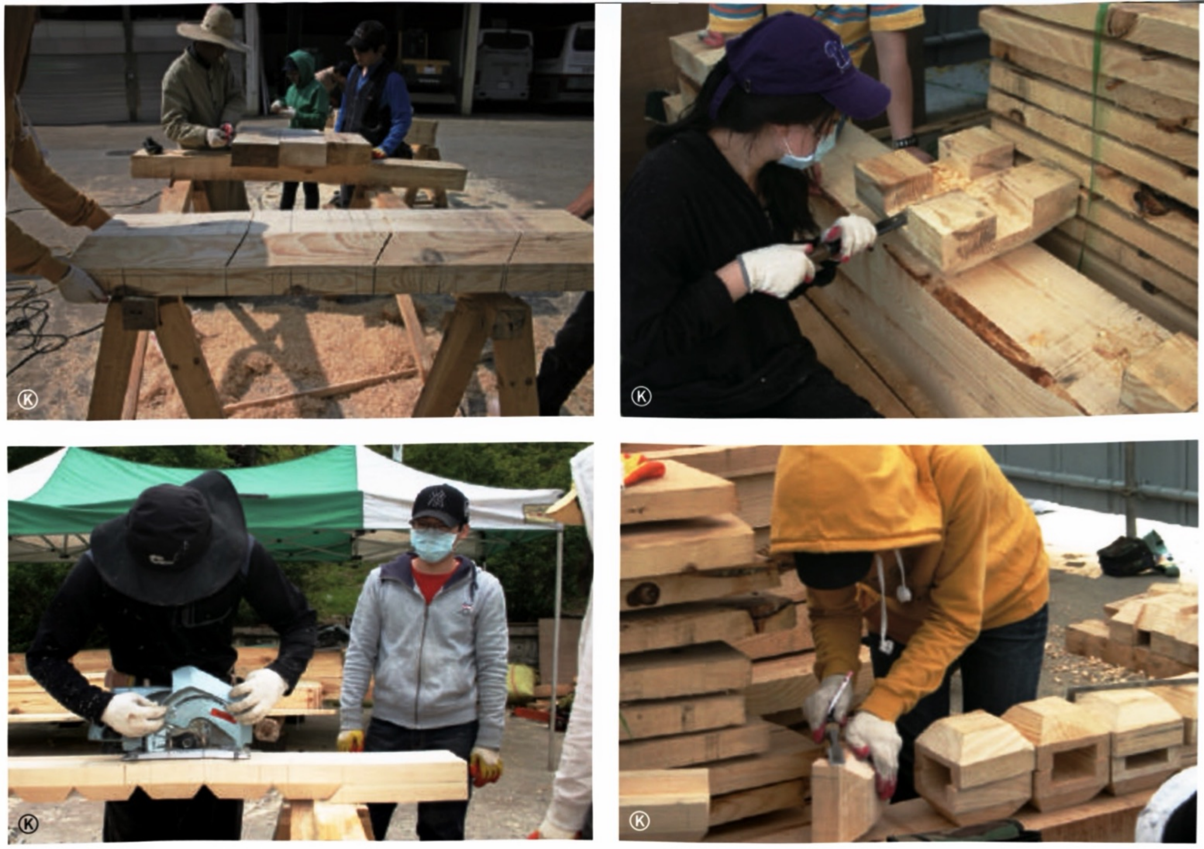
1) Capital[judu]

Only with the house type decorated with small bearing blocks(sorosujang-style), there is the capital[judu] placed on the column to support the beam and purlin supports[jangyeo]. One capital is placed on each column.

Every capital should be the same size.

Inner tree, growth rings, and concave side should face upwards so that the furrow at the top side of the capital[gal] is less transformed. Because all of the capitals should be the same size, mark with ink, plane, and trim a long piece of timber at once.

Mark the center as reference for assembling. Have the growth rings face the side and mark the front side on end of the member.



1 2 — 1 Marking and trimming capital 2 Carving dovetails
3 4 3 Trimming small bearing block 4 Chiseled work

When carving dovetails, consider that the beam and purlin support[jangyeo] will be framed. When the timberwork is done, mark on the carpenter's blueprint and store the timber.

2) Small bearing block[soro]

Marking and trimming the small bearing block[soro] is the same with that of the capital [judu]. Every small bearing block has to be the same size. Have the growth rings face the side and mark the front side on the top end of the timber.

Considering that the purlin support will be framed, carve a furrow at the top side of the capital[gal]. The width equals the breadth of the purlin support.

Once the timberwork is done, mark on the carpenter's blueprint and store the timber.

3) Connecting beam[changbang]

Only the house type decorated with small bearing blocks(sorosujang-style) has the connecting beam[changbang] to be framed with the capital. This holds one column and the other together. It is placed in between two columns.

Place the originally convex side of the timber face up and the bottom outwards the building and set on the workbench.

Mark, plane, and cut.

Mark ink lines on both sides from the top and bottom center point of the connecting beam at a width of the wall frame. Mark according to measurements with ink and plane the edges rounded.

Mark the center as reference for assembling.

Set the side with fewer cracks and knots as the front side for aesthetical purposes and mark this side on the top end of the timber.

Mark the mortise where the connecting beam is to be assembled(core bay, side bay) and dress the timber.

Once the timberwork is done, mark on the carpenter's blueprint and store the timber.

1 2 | Timberwork for column connecting beam

3. Purlin[dori], beam[bo]

1) Purlin[dori]

The purlin[dori] is the member that supports rafters and transfers the load from the roof to the ridgepole and column.

For a 3-ryangga Hanok, 3 purlin supports[jangyeo] in total(two purlins on column row[jusim-dori] and one top purlin[jongdori]) are required for every bay.

Have the convex side of the purlin timber face upward, the bottom end face outwards the building and place on the workbench.

Mark with ink, cut, and dress.

Mark the center as reference for assembling. Mark out the guideline on the curved surfaces of the purlin and use as reference for joining with the main beam[daedeulbo].

For the rectangular purlins, the guideline should be located at one-third point from the top end: for the circular purlins, the mid-line.

Set the side with fewer cracks and knots as the front side for aesthetical purposes and mark this side on the end of the member.

Mark the joining line with ink and dress.

Once trimming is finished, mark on the carpenter's blueprint and store the timber in the warehouse.

2) Beam[bo]

The beam[bo] is the member that transfers the load from the roof to the columns. Its convex part should face upwards.

Marking the center line on a purlin

Marking and trimming purlin

It is important that the joints on the beam are leveled at the same height because all the column, purlin support[jangyeo], purlin, and truss post[daegong] should be interlocked.
Mark ink lines on all sides of the member. On the top and bottom side of the beam, mark the center. On the sides, mark the center line on the sides where the beam will join the purlin.
Once the planing and cutting is finished mark the center and use it as reference for assembling.
Mark the front side on the end of the member.
Mark and trim the joints according to the joining method(mindori, sorosujang). Trace the head of the beam[bo] according to design.
For a 3-ryangga Hanok, form a surface for the truss post[daegong] to be laid and with a chisel carve a hole for the tips.
Once the timberwork is done, mark on the carpenter's blueprint and store the members in the warehouse.

1 2 | Planing and cutting beam

4. Truss post[daegong]

The truss post[daegong] is a member that is placed on top of the main beam[daedeulbo] and supports the top purlin[jongdori]. Its function is similar to the column.
There are as many truss posts as main beams.

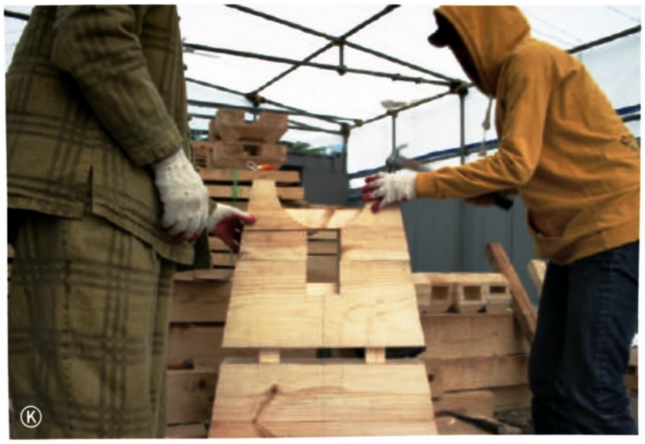
The flat truss post can be made by layering several components. Before cutting, bundle up all the members. Then, mark with ink and cut at once.

When overlapping the components alternate the inner and outer parts of the wood so that there is less dry shrinkage.

Once the flat truss post is completed, trace the mortise connecting the top purlin[jongdori]and top purlin support[jongjangyeo] and dress.

Carve holes for tips with which the components of the flat truss post are joined together.

Marking and trimming truss post



Joining the components of the flat truss post

11

Timberwork II
: roof structure

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1. Rafter[seokkarae]

Rafter are a major part of the roof frame and form.

1) Placing rafters in order

The rafters create the base surface for the roof tiles and transfer the load from the roof to the purlin[dori] and beam[bo].

The roof curve is formed by the rafters. Such rafter curve is formed not only for gambrel roof but also for gabled roof, and rafters are placed in a certain order to form the curve.

Set the middle as 0, where the rafter curve is flat, and number the rafters according to curvature; the numbers increase as the curvature increases.

The slope between the top purlin[jongdori] and the purlin on column row[jusimdori] is straight. From the purlin on column row to lower purlins, a bend is given until the end.

2) Rafter marking and trimming

Have the concave side of the rafter face upward so that the eaves are naturally lifted like a cantilever.

Arrange the placement of the top purlin[jongdori], purlin on column row[jusimdori], and the end according to the adequate curve marking. Mark the supposed location on the top end of the rafter. Cut to this ink line along the marking board surface.

Plane the top end of rafter flat and mark the center. This mark will serve as reference when assembling the rafter and shingle[gaepan], so it should not be erased.

On the top end of the rafter, mark a line for the laths on rafters[pyeonggodae] and write the numeric order of the rafter. Also trace a circular or an elliptical shape according to the plan on the top end surface of the rafter. Then it is finally ready for trimming.

Plane the surface neatly starting from the ink line at the end of the rafter to the position of the purlin on column row.

Once trimming is completed, mark on the rafter table and make sure that rafters are not left out.

1 2 — 1 Rafter design drawing 2 Marking and trimming rafter
3 4 3 Marking and trimming rafter 4 Marking a line on rafter

2. Lath on rafters[pyeonggodae], shingle[gaepan], barge board[bakgong], rafter on gable board[mokgiyeon]

1) Lath on rafters[pyeonggodae]

The lath on rafters[pyeonggodae] is a member that connects the additional rafters[buyeon]. It also has the function of adjusting the rafter curve when assembling the rafters.

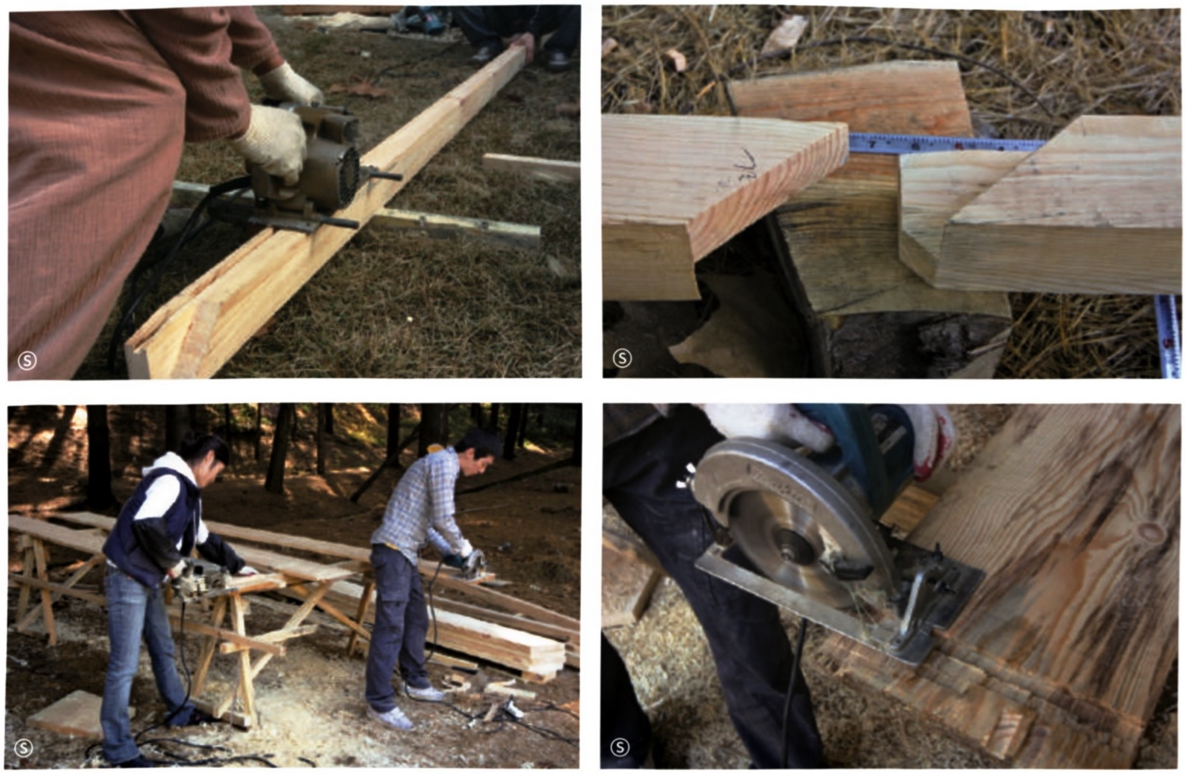
It is a long member of 6~9㎝(2~3chi) thick.

The laths on rafters will be joined in the length direction. So each half of the end tips should be dressed slantly in opposite directions.

Dress a rabbet joint so that the shingle[gaepan] can be fixed.

2) Shingle[gaepan]

The shingle[gaepan] is a component that covers the rafters and forms the flat surface for the

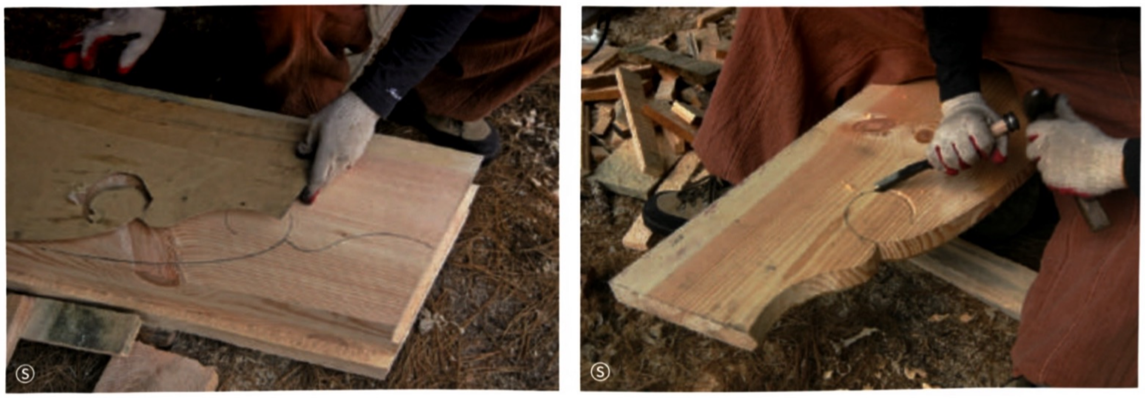


1 2 — 1 Dressing a rabbet joint for interlocking with shingles 2 Joining laths on rafters in the length direction
3 4 3 Trimming shingles 4 Dressing a rabbet joint for interlocking with laths on rafters

The width of the shingle is decided according to the distance between the rafters.
Dress a rabbet joint at the ends so that it can interlock with the laths on rafters[pyeonggodae].

3) Barge board[bakgong]

The barge board[bakgong] is a component that covers the end rafter on both sides of the building and serves as decoration.
Because the surface of the barge board is exposed to weather, have it be a single component so that the wood is less defected. Also mark the front side with less dents exposed.
Trim the top and bottom surface of the barge board along the ink line. Carve the swirl decoration of the barge board using the design pattern.

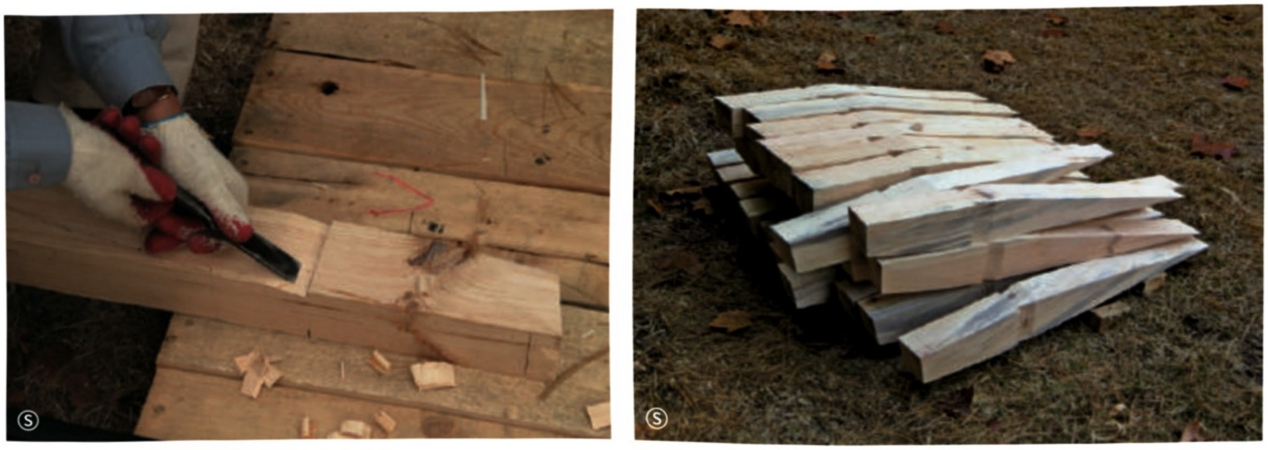


1 2 | Carving the swirl decoration of the barge board

4) Rafter on gable board[mokgiyeon]

The rafter on gable board[mokgiyeon] is a component that is placed perpendicularly on the barge board. When the shingle is placed on them, the basis for the roof tiles is formed. Cut uniform rectangular timbers to the necessary length and plane.

Dress the joints that will join with the barge board, and dress the slanted ends.



12 | Cutting and trimming rafters on gable board

12

Column erecting

The column erecting ceremony is to wish for safety before assembly.

1. Raising columns

When raising the columns, mark at a certain length from the bottom end of the column. This will be a reference point to measure the height difference between the columns.

Column erecting is the start of assembling wooden elements of the Hanok. Set the leftmost column in the front as a reference.

2. Reference column

Raise the column so that the center ink mark of the column and that of the column base stone meet. Brace with a wooden block. Check with a plumb bob that the column is perpendicular to the ground, and if needed, adjust with a wooden prop.

After fitting two components for connection[geurejil], lay the column down and cut off the excess length at the foot of the column.

To reduce damage from dampness, carve the bottom of the column so that it is caved in.

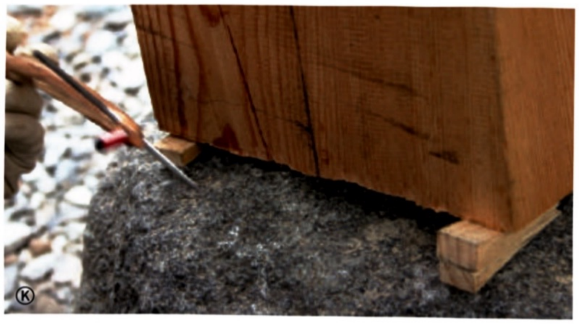
Raise the column once again and check if it is perpendicular to the ground. The reference column is all set.

Erecting column - Marking at a certain length from the bottom end of the column

3. Remaining columns

Raise the rest of the columns and check if they are perpendicular to the ground.
Measure the height difference of the columns that comes from the various heights of the column base stones and take into consideration when fitting two components for connection [geurejil]. If the column base stone is shorter than that of the reference column, the marking must be done higher and if the column base stone is taller, the marking must be done lower to meet the balance.
Trim the individual column according to the marked lines and carve the bottom so that it is caved in. Raise the column once again and check if it is perpendicular to the ground.

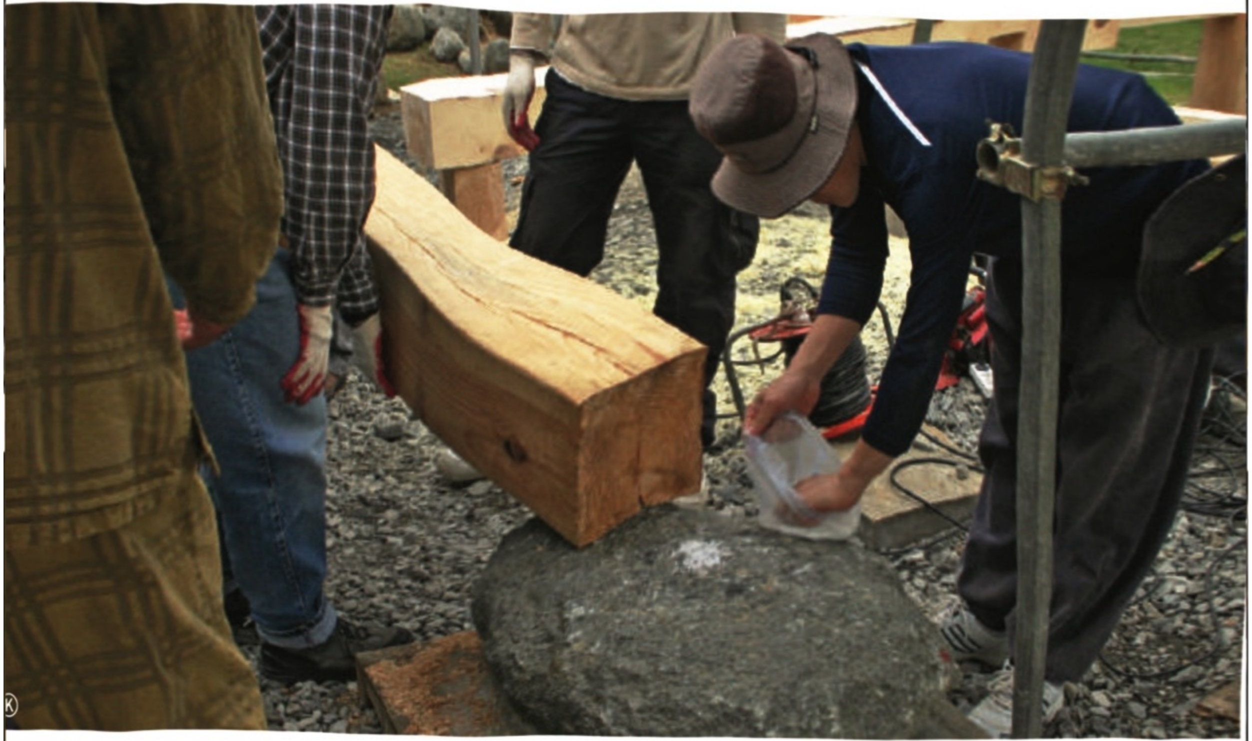
Reference column - Checking verticality and centered location



Fitting two components(column and base stone) for connection

4. Column erecting ceremony[ipjusik]

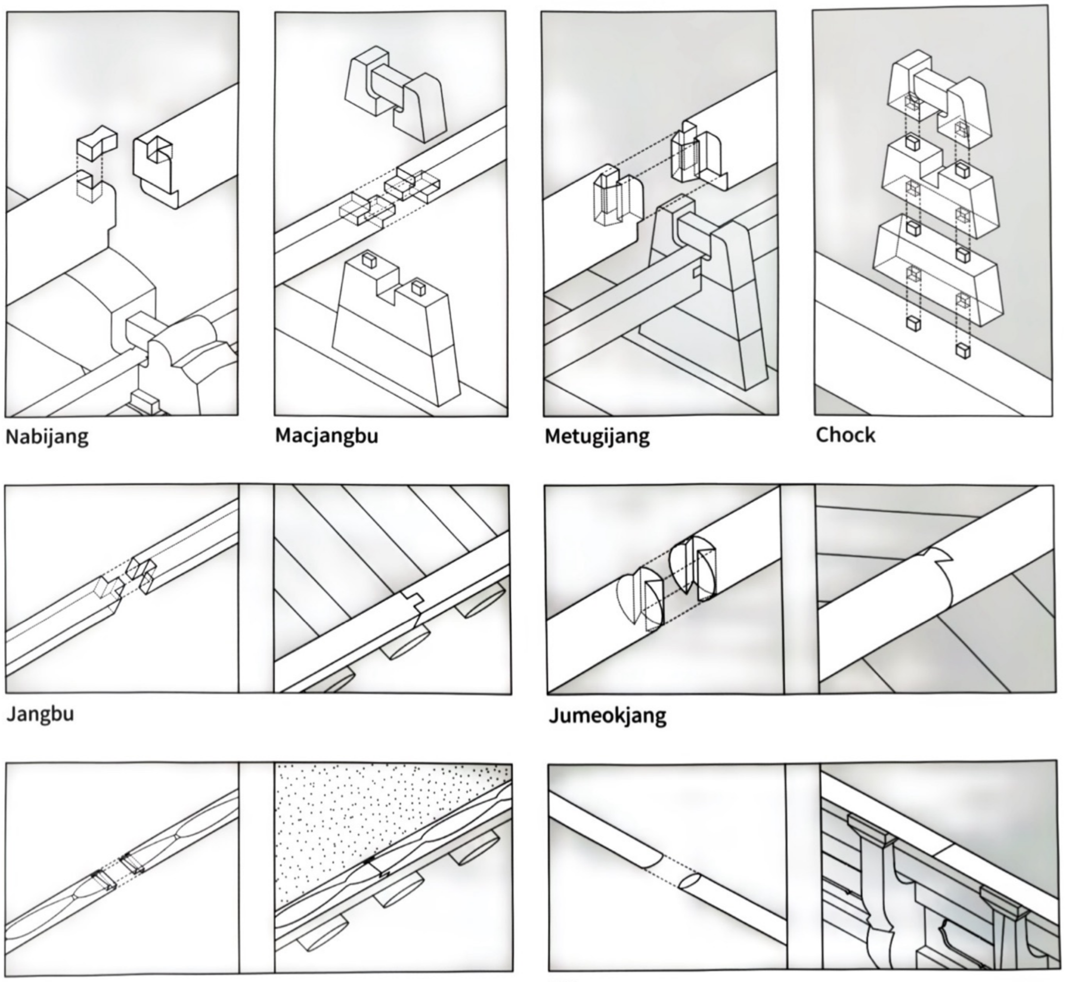
The column erecting ceremony is a ritual to celebrate the completion of the trimming and the start of assembling of members on the site. Carpenters also have to be ready from this point to



Structural frame assembling

Assemble the trimmed structural members in the right order.

1. Longitudinal joint[ieum] and Cross joint[matchum]



Nabijang

Macjangbu

Metugijang

Chock

Jangbu

Jumeokjang

Banteok

Bit

Types of joint

The wooden members of the Hanok interlock with each other using longitudinal joints[ieum] and cross joints[matchum]. An ieum refers to the act of joining two members longitudinally or the joint formed in that manner. A matchum refers to either the act of joining two members perpendicularly or the joint formed in that manner. The following figure shows commonly used longitudinal joints.

2. Assembling simple structural frame[mindori]

The simple structural frame which is called mindori is a Hanok type without bracket sets.

Order of assembly:
column → beam support[boaji] → purlin support[jangyeo] → beam[bo] → purlin on column row [jusimdori] → truss post[daegong] → top purlin support[jongjangyeo] → top purlin[jongdori]

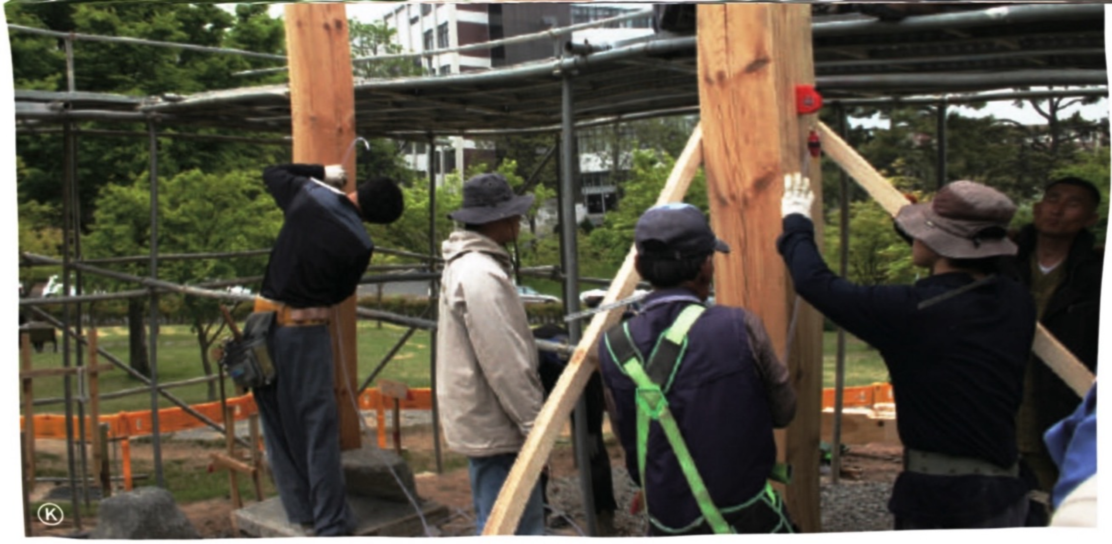
Make sure to place a portable scaffold since the assembly is done at a considerable height.
Assemble the members according to order.
With a mallet, pound members that do not fit in and when it does not work, plane with a chisel on the spot.

3. Assembling decorated structural frame[sorosujang]

The decorated structural frame which is called sorosujang is a Hanok type decorated with small bearing blocks under the bracket components.

Order of assembly:
column → beam support[boaji] → connecting beam[changbang] → capital[judu], small bearing block[soro] → purlin support[jangyeo] → beam[bo] → purlin on column row[jusimdori] → truss post[daegong] → top purlin support[jongjangyeo] → top purlin[jongdori]

The assembly method is same as that of the simple structural frame[mindori].



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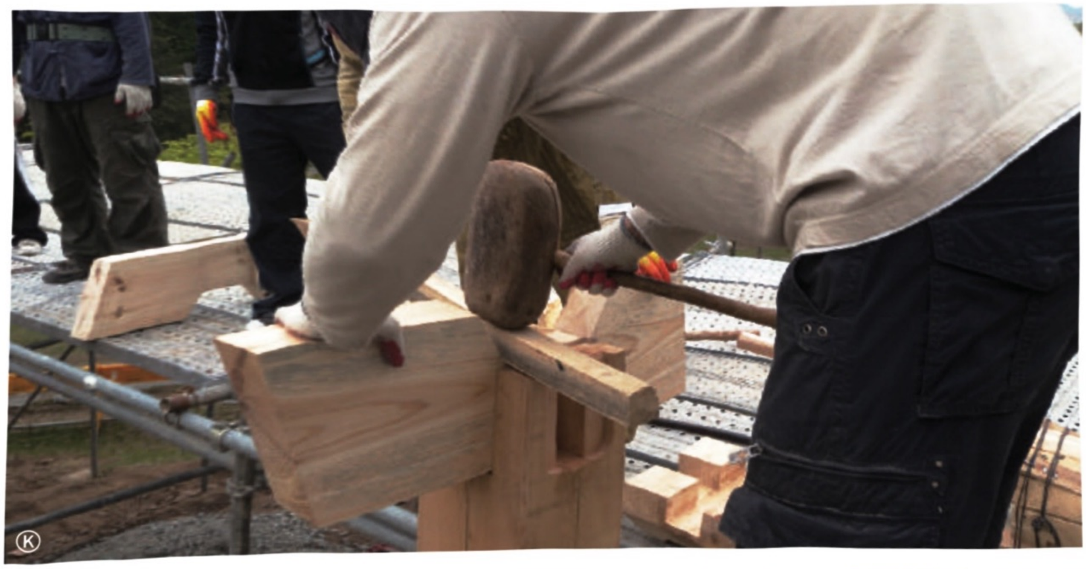
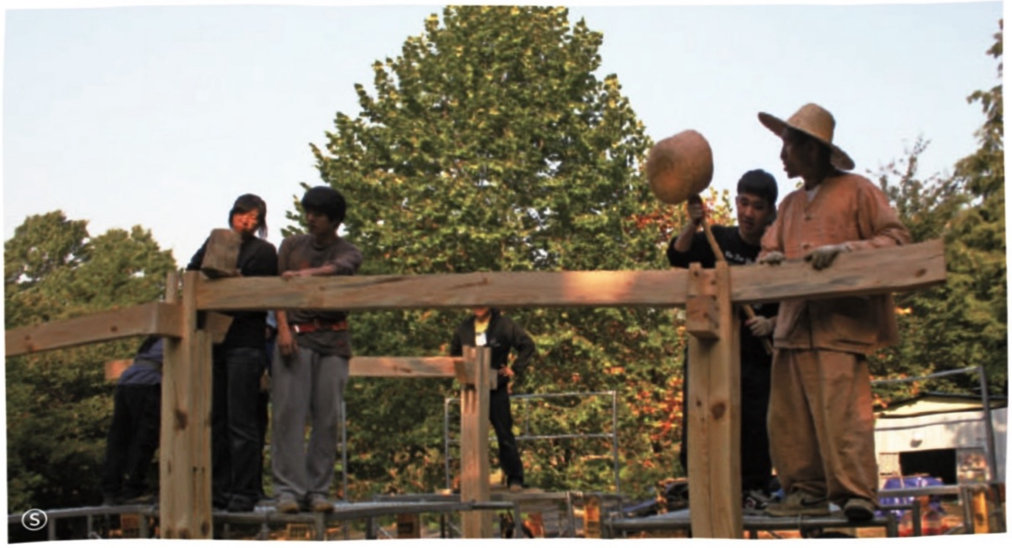
1 Erecting column

2 Assembling beam support





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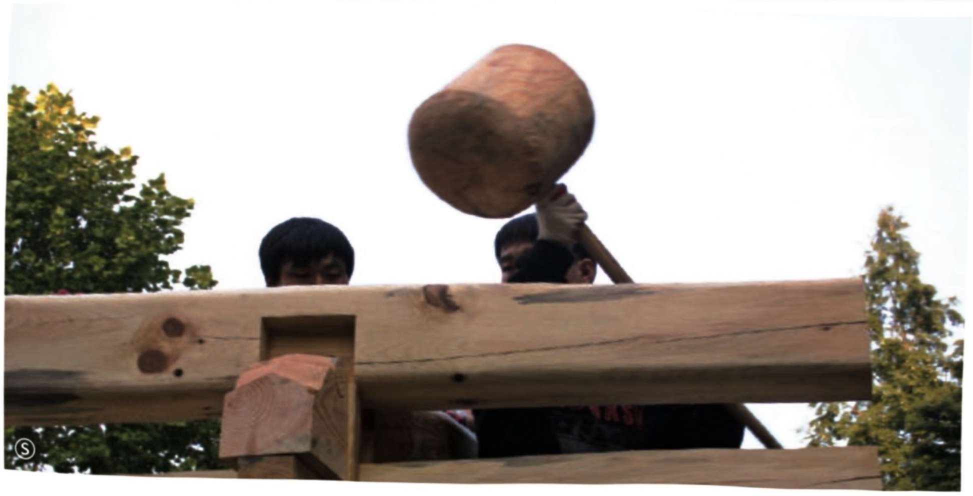
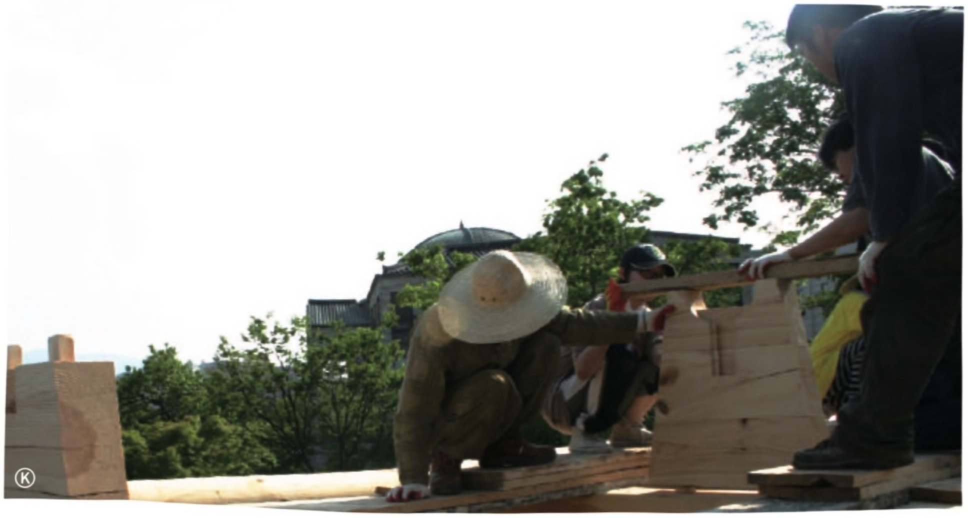
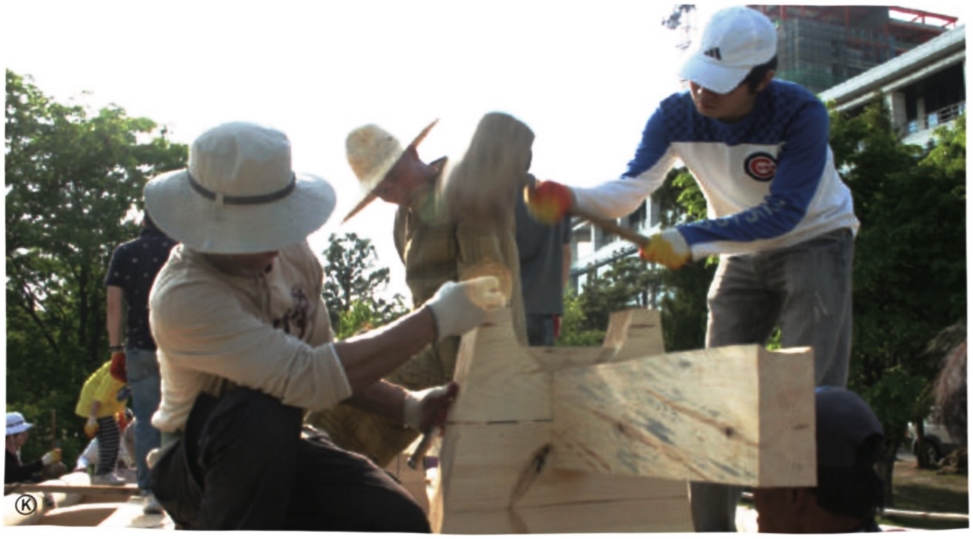
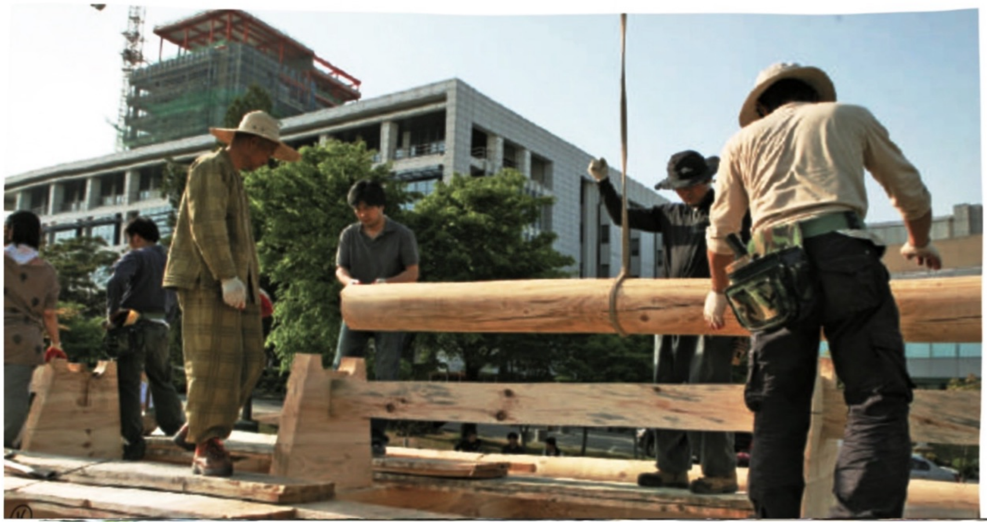
5 Assembling purlin with mallet

6 Assembling truss post









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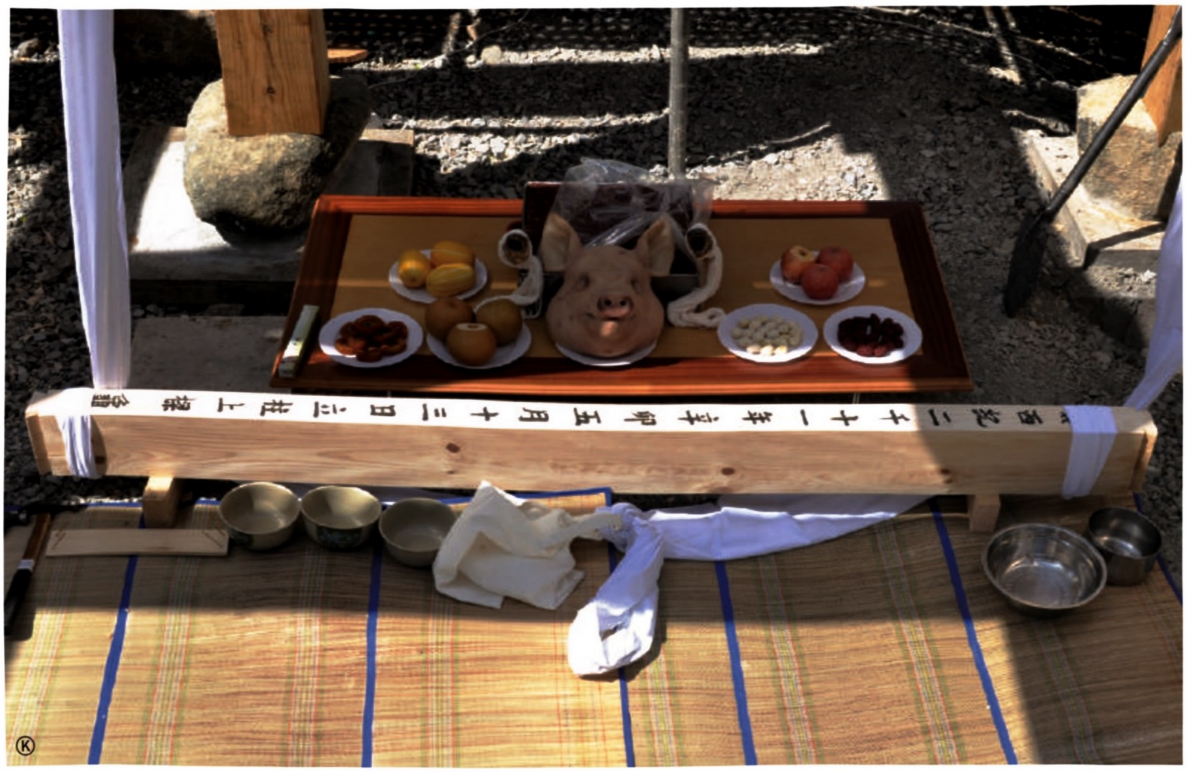
7 Assembling top purlin support

14

Framework completion ceremony

Framework completion ceremony[sangryangsik]

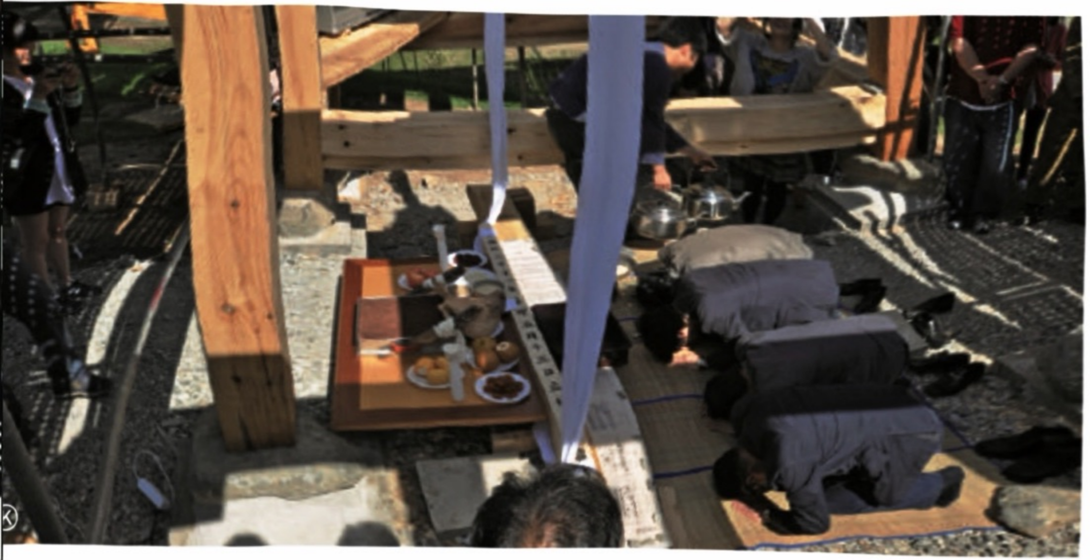
The framework completion ceremony is held to congratulate the completion of the frame and encourage carpenters for their hard work. It is the biggest ceremony of the Hanok construction as it is held to commemorate that the dangerous assembly of heavy members is accomplished without any accident. The placement of the roof ridge[yongmaru] indicates the official completion of the overall framework. At the same time, this ceremony is an official opportunity to present the new Hanok for the owner.

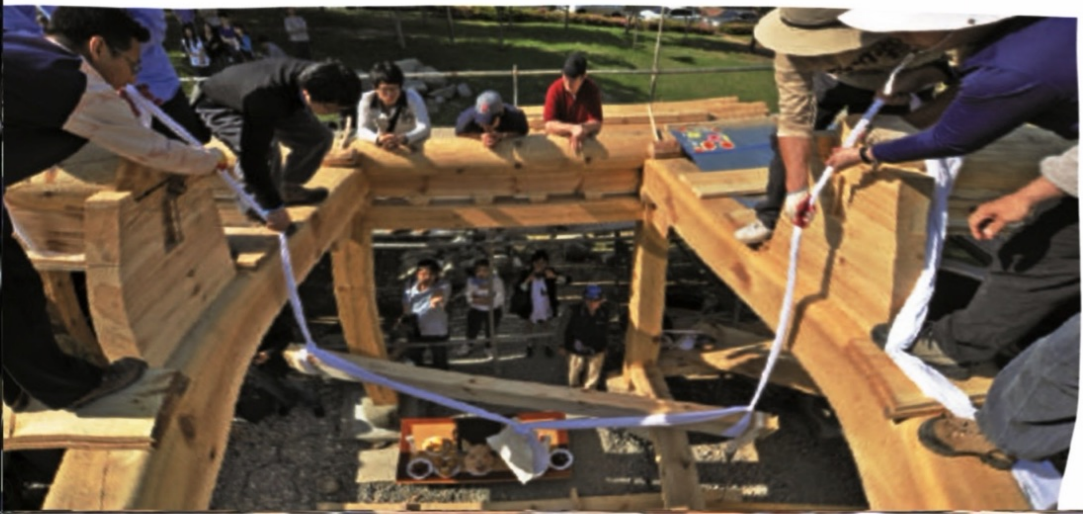


Framework completion ceremony

nstruction are stated.

owner, and participants of





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1 Carving a hole to store the framework *completion letter*

2, 3 Framework completion ceremony

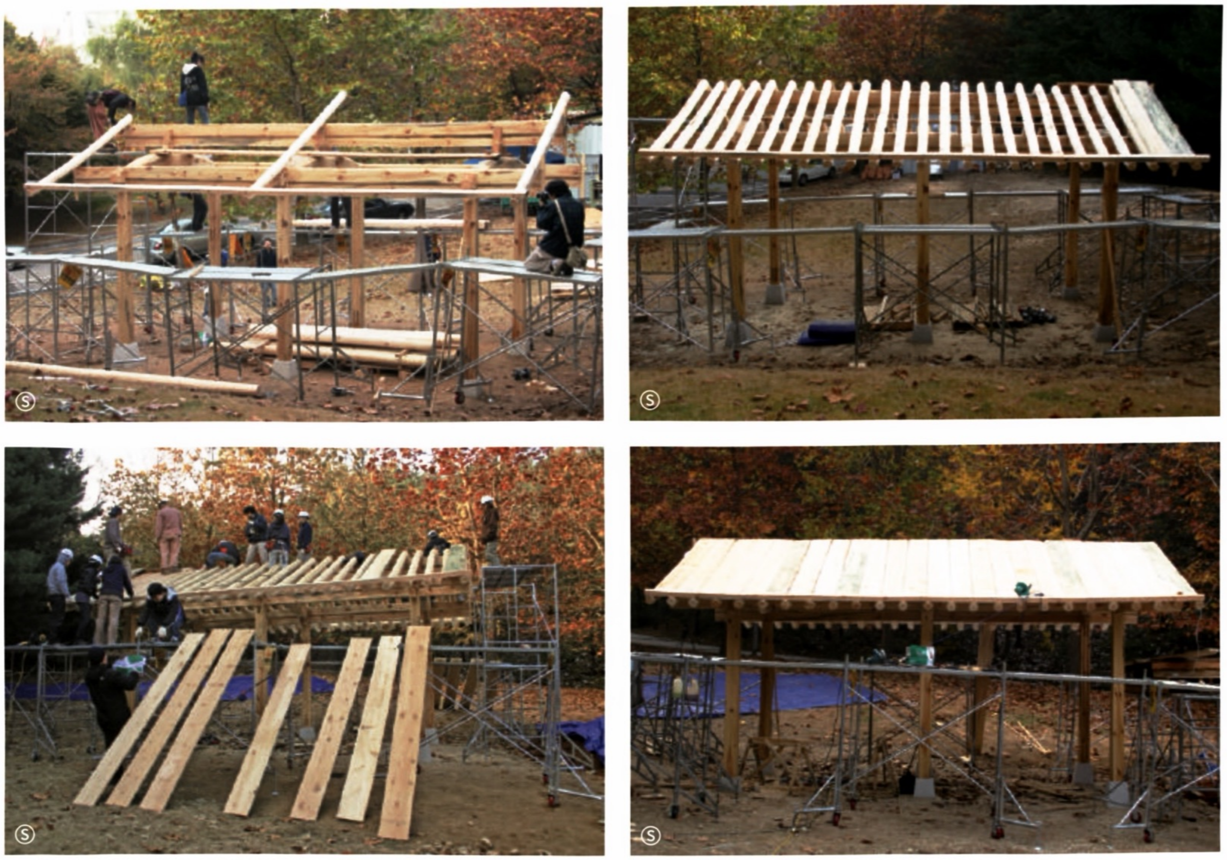
15

Roof structure assembling

Assemble trimmed roof components and place the roof pressing board[nurigae].

1. Barge board[bakgong], rafter on gable board[mokgiyeon]

Because many workers and materials will be placed on the roof, it is safe to fix the lower structural frame with a bracing or a belt. There is the danger of long nails and saws falling when used on the roof. Therefore, safety helmets are mandatory for everyone on site.
Place the first, middle, and end rafter on the purlin[dori] and temporarily fix with a long nail. Then, lay the laths on rafters[pyeonggodae] on top to form the rafter curve. Once the rafter curve is complete, sturdily fix the reference rafters to the laths on rafters with nails.
Lay the rest of the rafters according to their order by curvature. When there is an error with the roof curve, check the curvature of the rafter on the workbench and then fix with a long nail on the purlin[dori]. Cut with a saw when the head of the rafter is too long.
Place the shingle[gaepan] along the center ink mark on top side of the rafter and insert the bottom of the shingle into the grooves of the laths on rafters. Cut the shingle on the spot when it goes over the center ink mark.
The shingle and rafters are fixed together with nails. On one side of the shingle, drive nails in directly. On the other side, hammer nails slantly on the side of the shingle[gaepan] and bend the head to grasp the shingle. This is to protect the shingle from damage from dry shrinkage.
Trim the shingle with a saw if it is too long.



1 2 — **1, 2 Fitting rafters**
3 4 **3, 4 Placing the shingle**

2. Barge board[bakgong], rafter on gable board[mokgiyeon], roof pressing board[nurigae]

Fix the barge board[bakgong] on end side rafters with nails. The pair of barge boards on the same side should be placed slightly apart from each other to prevent damage.

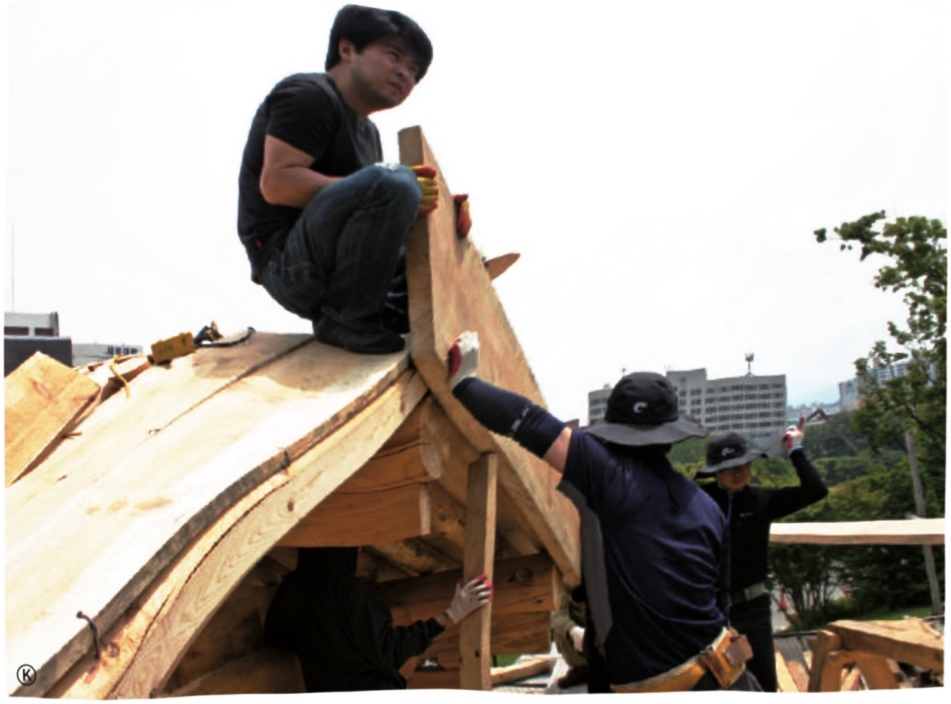
Decide where to place the rafters on gable board[mokgiyeon] and carve. Fix the end of the rafters on gable board[mokgiyeon] to the roof pressing board[nurigae].

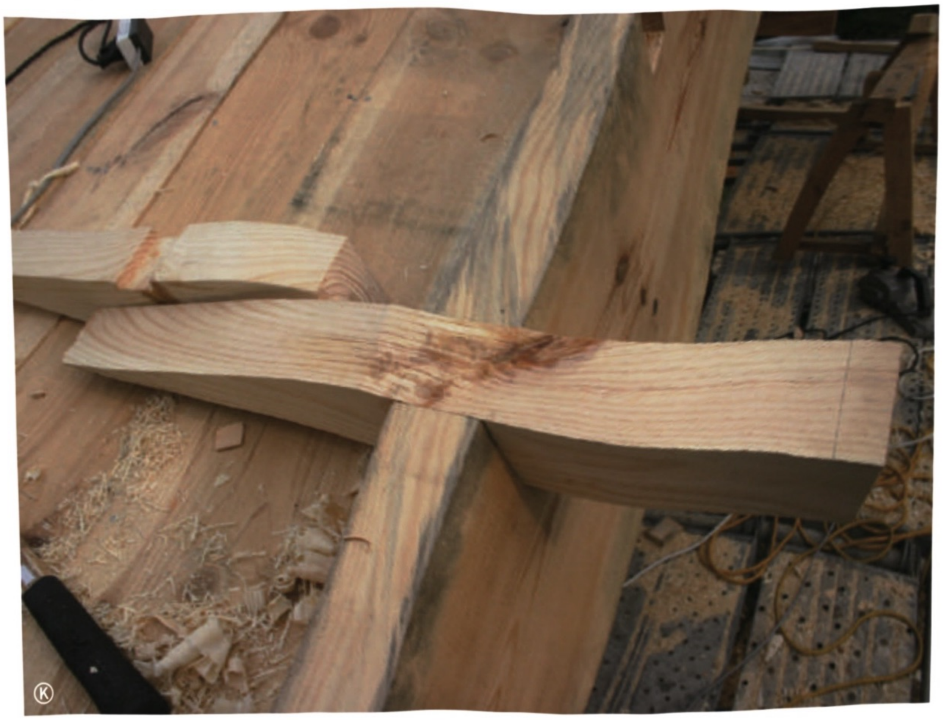
Fix the rafters on gable board into the barge board.

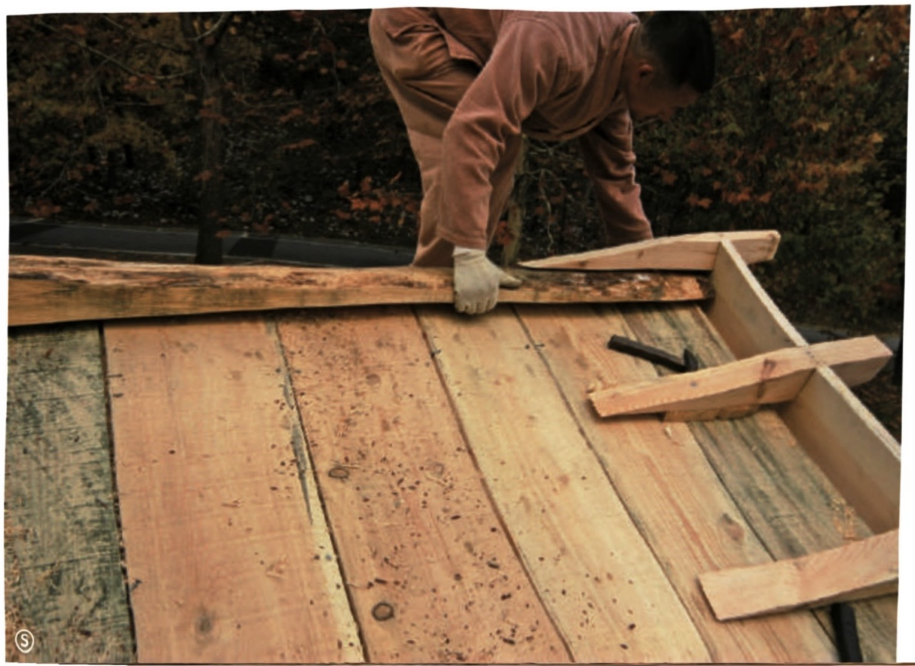
The roof pressing board[nurigae] is placed to reinforce the rafter and shingle[gaepan] and to disperse the load of the roof thoroughly onto the roof surface. On the other hand, roof filling woods[jeoksim] are placed in the process of roof tiling construction to form the roof curve.

Roof pressing boards are mostly placed on the surface of barge board or eaves where the load carrying capacity is large to spread out the weight distribution.

The roof pressing board is fixed to the shingle with nails.







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—
1 Fixing
2 Fixing
gable

16

Roof tiling

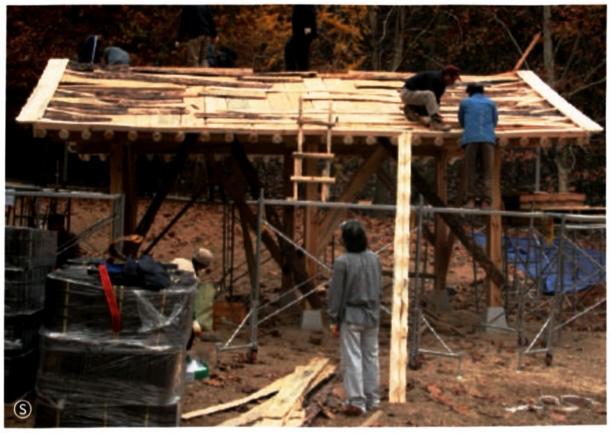
Roof tiling includes the process of 1) making the foundation with roof filling wood[jeoksim] and roof filling soil[boto], 2) tiling in the order of pan tiles and cover tiles.

1. Roof underlayment

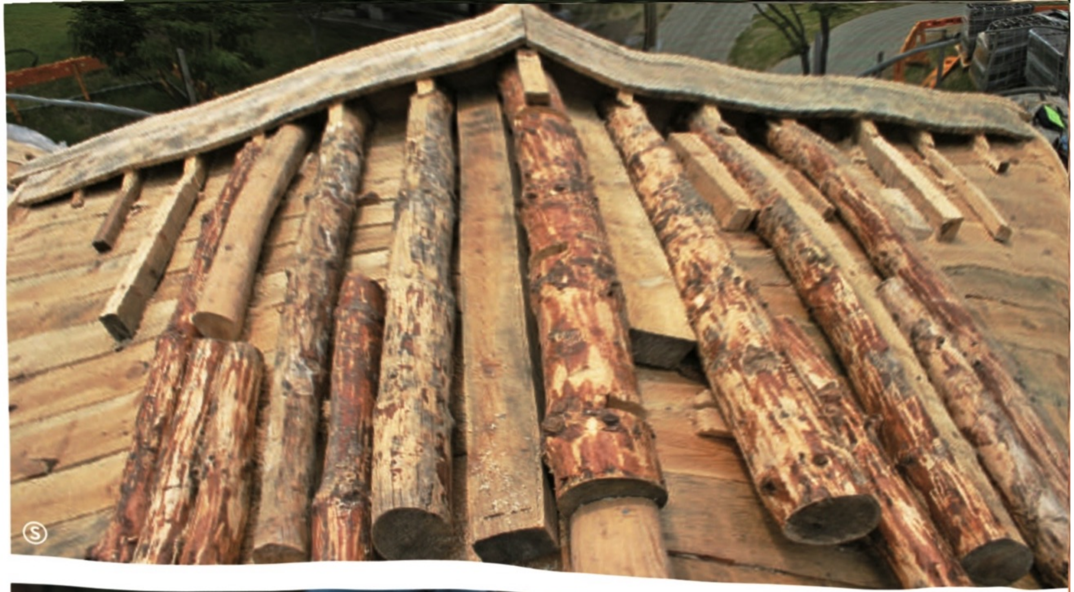
The roof underlaying construction involves forming the pitch of the roof and roof curve while also having the purpose of reinforcing the frame.

1) Laying roof filling wood[jeoksim]

While knotted hay strings, planks, or shingles can be used for the roof surface, today shingles are generally preferred because of cost and convenience of construction. Roof filling wood[jeoksim] can be placed right on roofs where shingles are laid. Logs or left over wood can be used as roof filling wood. The roof filling wood prevents the rafters from moving independently and forms the shape and curve of the roof. For buildings over 5-ryangga that use both long rafters and short rafters, many roof filling wood pieces are laid toward the end of the long rafters. On the other hand, for 3-ryangga, where only one type of rafter is used, roof filling wood is laid on the eaves so that it reinforces the roof curve.



Making the roof foundation with roof filling wood



1 — 1 Making the roof foundation with roof filling wood
2 2 Trimming the pan tile supporting laths

2) Timberwork and assembly of pan tile supporting laths[yeonham]

The pan tile supporting lath[yeonham] is a component that directly supports the roof tile. The upper part of the pan tile supporting lath is made to be a concave shape in order to fit the form of the pan tile. Therefore, the pan tile supporting lath is trimmed by the roof tile craftsman although it is a wooden component. A trace for the pan tile supporting lath is made of the width of the roof tiles. With this trace, a chain of pan tile supporting laths is drawn, and the wood is accordingly trimmed. The completed pan tile supporting lath is fixed on top of the laths on rafters[pyeonggodae] at the end of the rafters. Then, finally, the roof tiling begins.

3) Laying roof filling soil[boto]

After laying the roof filling wood[jeoksim], roof filling soil[boto] should be added. Roof filling soil is used to fill the spaces between roof filling woods and form a gradual roof surface. Roof filling soil is an important foundation material that makes the curvature of the roof curve. Also roof filling soil prevents the roof tiles from directly meeting with the wooden members underneath and is an effective method of insulation and waterproofing. In the past, when timber was rare, the roof curve was formed mostly using the roof filling soil, but nowadays roof filling wood is more utilized so that less roof filling soil is needed.

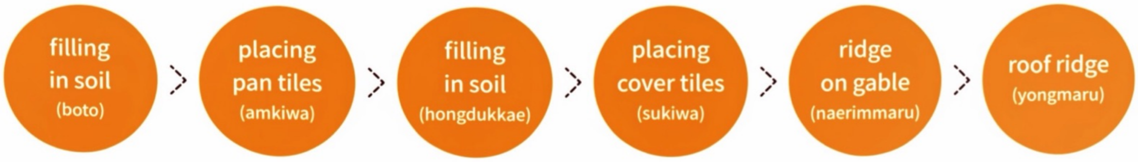
With a multi purpose excavator, mix in mud and cement soil to the hardened quicklime mud mixture and scoop on top of the roof. It takes $0.9m^3$ of mud, $0.3m^3$ of cement soil, and 7.8kg of quicklime to make $1m^2$ of roof filling soil.

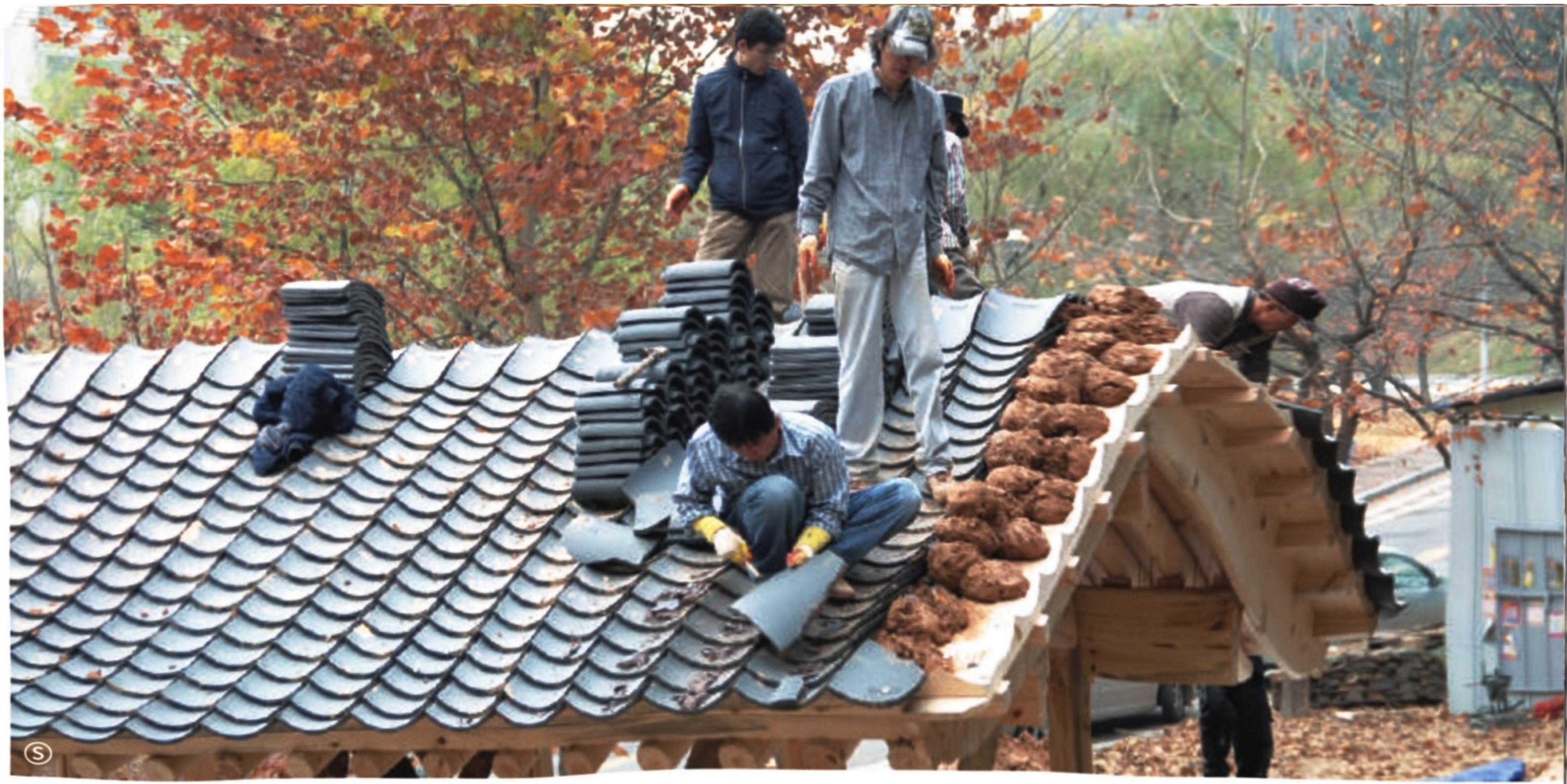
4) Reinforcing quicklime

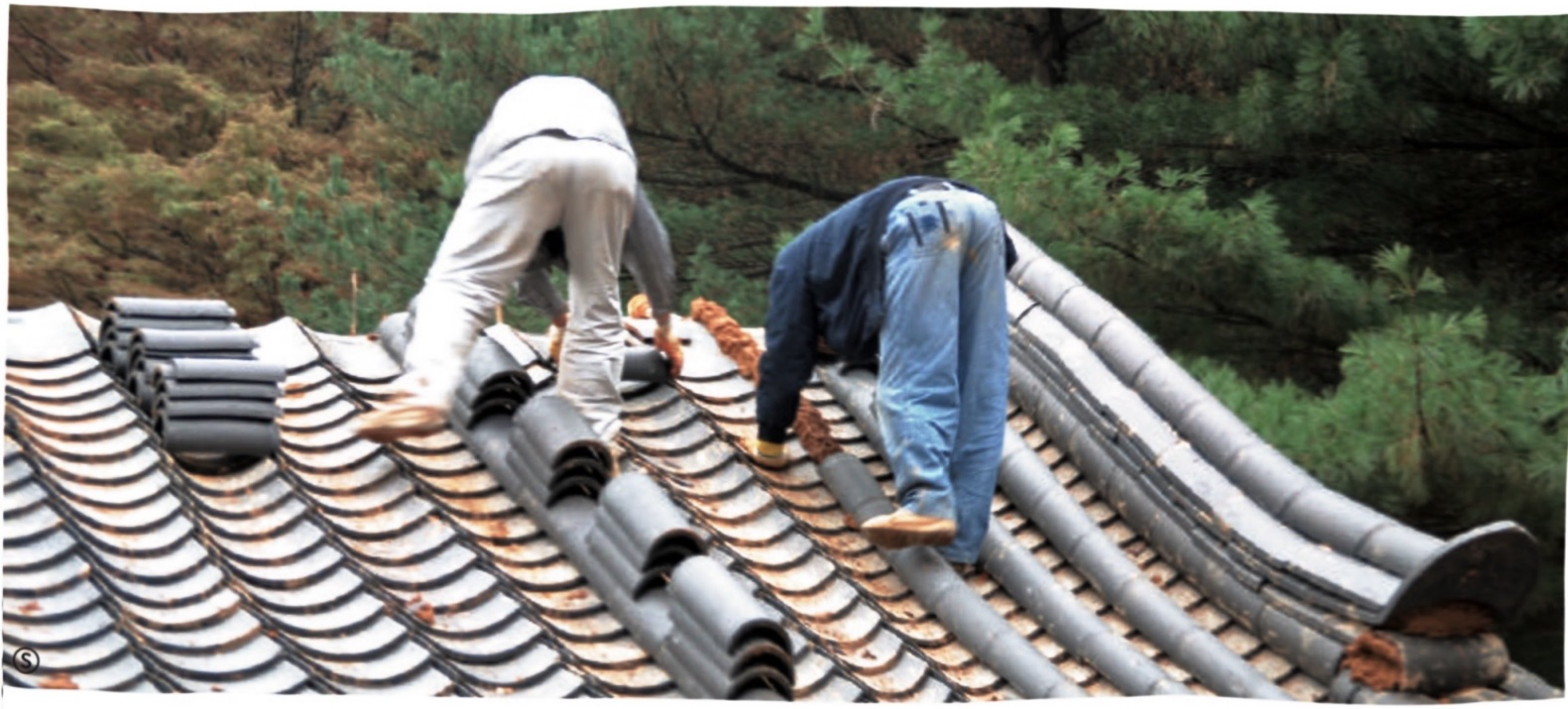
After packing the roof filling soil, apply reinforced quicklime. The quicklime firmly sets the soft roof filling soil and also has a water proofing effect. This offsets the flaws of the roof tiles.

2. Roofing with tiles

The roofing follows the order of <filling in soil[boto] → placing pan tiles[amkiwa] → filling in soil[hongdukkae] → placing cover tiles[sukiwa] → ridge on gable[naerimmaru] → roof ridge[yongmaru]>


filling in soil (boto)
placing pan tiles (amkiwa)
filling in soil (hongdukkae)
placing cover tiles (sukiwa)
ridge on gable (naerimmaru)
roof ridge (yongmaru)





1 — 1 Placing pan tiles
2 2 Placing cover tiles

then press down to fix the cover tile. The cover tile must be fully packed with soil to prevent from sliding.

3) Laying roof tiles on gable[neosaegiwa]

Roof tiles on gable[neosaegiwa] are placed on the rafters on gable board[mokgiyeon] or gable, and they are placed perpendicularly to the pan tiles and cover tiles. The construction method is same as the previous roof tiles in that the roof tiles on gable also use the pan tile supporting lath, pan tiles, and cover tiles.

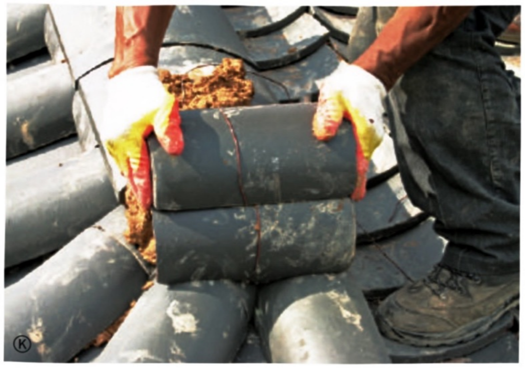
4) Laying roof tiles on ridge of a roof[marugiwa]

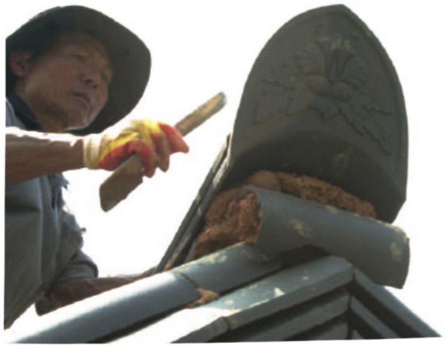
The roof tiles on the ridge of the roof[marugiwa] include the roof ridge[yongmaru], ridge on gable[naerimmaru], and ridge on angle rafters[chunyeomaru], but for the gabled roof[matbae-jibung], there is no ridge on the angle rafters.

The roof tiles for the ridge on gable is tiled at the same time with the cover tiles, and the roof ridge is placed after the cover tiles are laid.

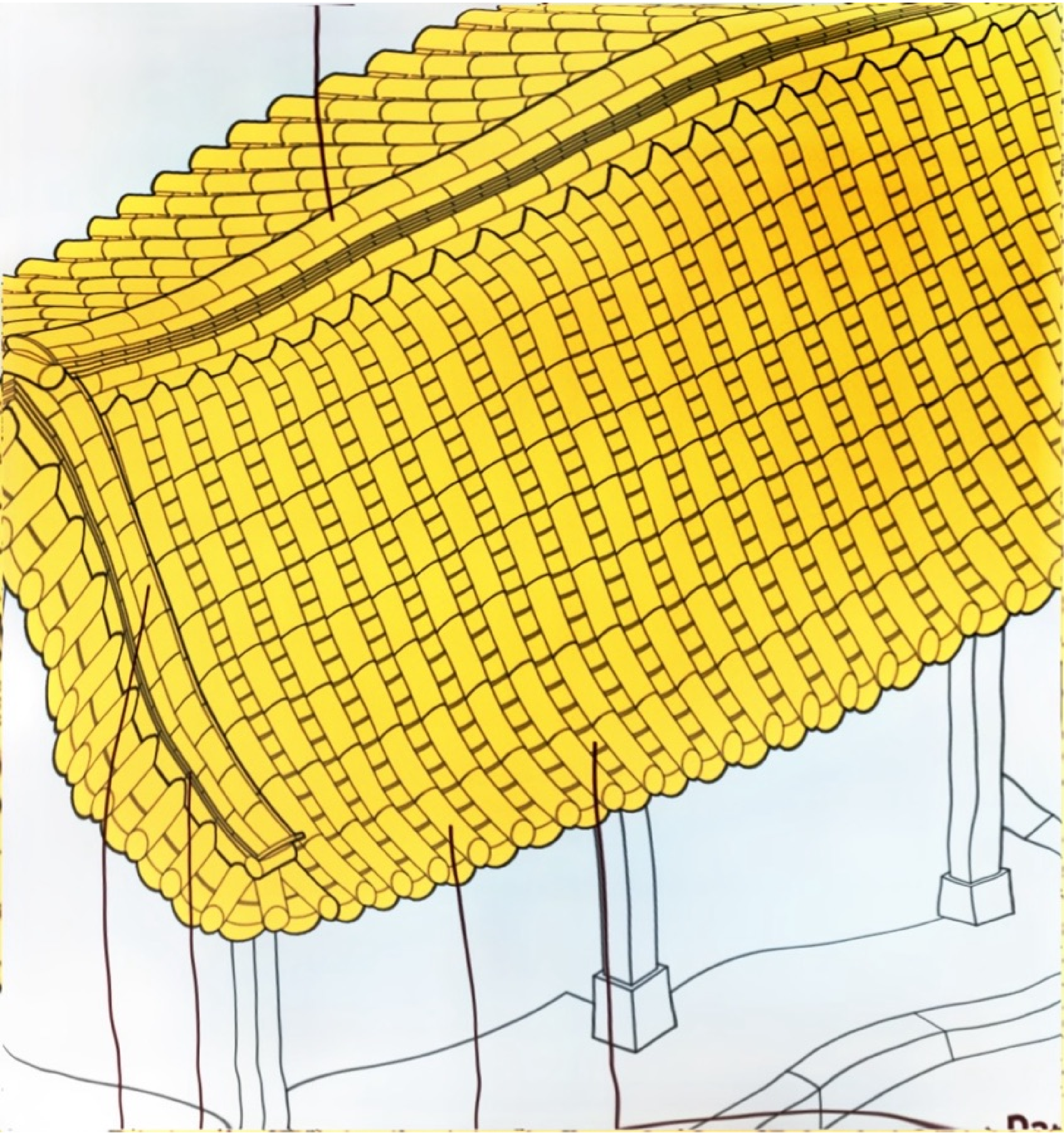
For the roof ridge, place tiles on their sides to fit the curve of the cover tiles laid below[chakgo]; on top stack, place another layer of cover tiles on their sides[bugo], and then place layers of pan tiles facing upwards[jeoksae]. Pan tiles are laid in layers of odd numbers 3,5,7,9, etc. Here, stack the ridge on gable slightly lower than the roof ridge.

Finish by lining cover tiles on top of the upward facing pan tile layers. The end of the roof ridge is capped with a decorative tile[mangwa]. This roof tile has the aesthetical purpose of





1 2 — **1 Laying roof ridge 2 Capping**
3 4 **3 Capping with a cover tile 4 Capping with a decorative tile**

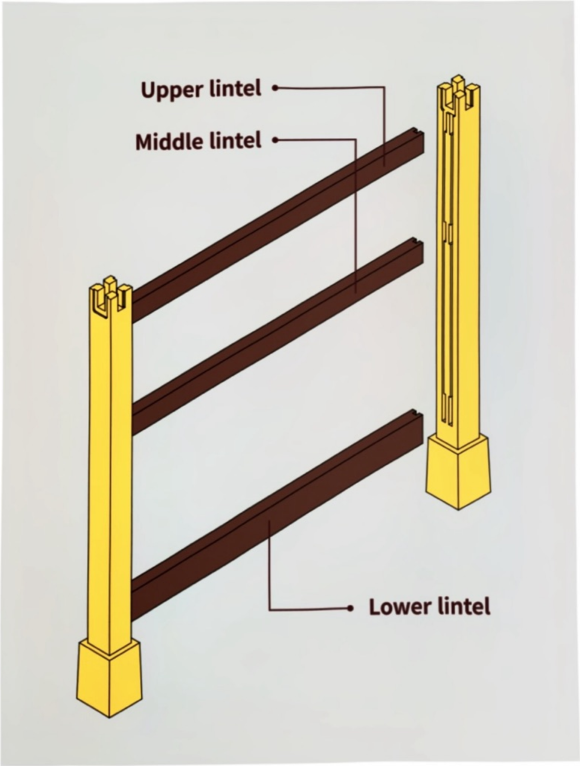


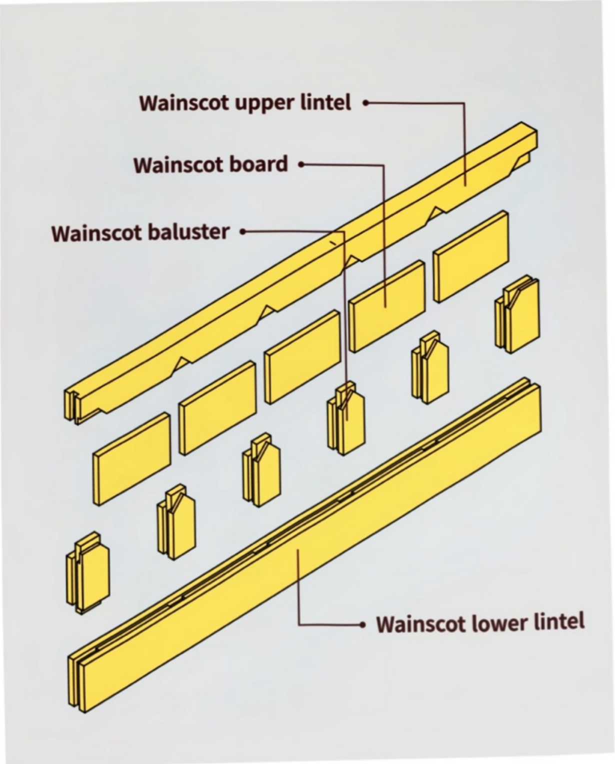
17

Wall frame construction

Components categorized as the wall frame have the same thickness. They form the space for walls, windows, and doors. These are composed of the lintel[inbang], wainscot[meoreum], jamb[munseon], and wall stud[byeokseon].

1. Wall frame timberwork


Upper lintel
Middle lintel
Lower lintel


Wainscot upper lintel
Wainscot board
Wainscot baluster
Wainscot lower lintel

1) Lintel[inbang]

The lintel is an important frame placed horizontally on the wall. The number of lintels and their location vary according to the composition of the wall.

Lintels are categorized according to their location: lower lintel, middle lintel, and upper lintel.

The lower lintel can be dressed with the wainscot[meoreum] above.

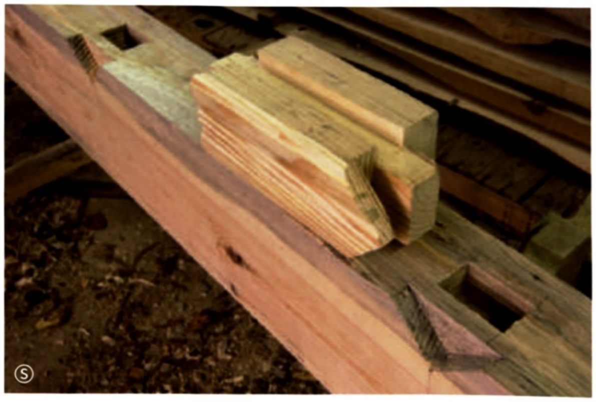
Have both ends of the lintel have double tenons. Here, make sure the length of the tenons are different considering assembly. It is easier to fit in the pieces when the ends of the tenons are chamfered.

When installing the windows and doors, carve a window/door sill on the lintel.

2) Wainscot[meoreum]

Wainscot is the window sill for a sedentary lifestyle. It is formed by raising short posts between the window sill and lower lintel and inserting planks in between.

The appropriate height of the wainscot should make it adequate to lean on with one's arm when sitting inside. This is about 45~54㎝(1ja 5chi~1ja 8chi).[6]



Wainscot baluster

The wainscot needs detailed trimming because the components such as wainscot upper lintel[meoreumsangbang], wainscot baluster[meoreumdongja], wainscot board[meoreumcheongpan], and lower lintel are intricately combined.

Have the wainscot baluster and lintel joined with tenon joints. Carve the end of the baluster into a upside down 'y'-shape miter and connect with tips.

3) Jamb[munseon] and wall stud[byeokseon]

The jamb and wall stud are the vertical members between the column and lintel. They form the borders of the windows, doors, and walls. Because windows and doors will be inserted into the jamb and wall stud, sills should be carved to required thickness.

The jambs must be trimmed to the prearranged shape because they will be fitted into the column. If the column is tapered column[minheulrim], the jamb has to have the corresponding shape, and long tenons are carved at the top and bottom to fit into the column.

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[6] For the explanation of Korean traditional measuring units, see the footnote on page 27.

2. Assembling the wall frame - lintel

The lintel[inbang] is the horizontal frame of the wall.

1) Work procedure

Assemble in the order of lintel → wainscot → jamb → wall stud

Assemble the upper, middle, and lower lintel to each position where the mud wall will be applied in between.

In order to insert the wall frame into the structural frame which is already raised, carve mortises with a chisel and plug in unnecessary mortises with dowels after assembling.

2) Assembling the lintel[inbang]

The lower lintel is placed regardless of the composition of the wall, so it is important to level the height of all lower lintels.

The middle lintel is usually fitted in the middle of the wall, but the height may change according to the doors and windows.

The upper lintel is placed right under the purlin support[jangyeo] or connecting beam[changbang], so the height is determined accordingly.

The assembly order for lintels varies in each construction site. However, the lintels are usually fixed to the columns in the order of upper lintel → middle lintel → lower lintel. It is better to fix the middle and lower lintel after assembling the jamb and wall stud. Moreover, it is convenient to support the lower lintel with a jack and adjust the height.

Assembling the lower lintel

Assembling the upper lintel

3. Assembling the wall frame - wainscot, jamb, and wall stud

The wainscot[meoreum], jamb[munseon], and wall stud[byeokseon] stand between the column and lintel and form the face of the door.

1) Assembling the wainscot[meoreum]

The wainscot is combined in the following order: place short wainscot balusters on the very lower lintel and insert wainscot boards[meoreumcheongpan] in between. Then cap with a wainscot upper lintel[meoremsangbang].

The wainscot acts as a window sill and also makes up part of the wall. Additional trimming is needed in the assembly process because several small components are combined to form the wainscot.

When assembling the lower lintel, use a jack to set it at the exact height.

Assemble the tenon joints in the order of wainscot baluster[meoreumdongja] → wainscot board[meoreumcheongpan] → wainscot upper lintel[meoreumsangbang].

wainscot baluster (meoreumdongja) > wainscot board (meoreumcheongpan) > wainscot upper lintel (meoreumsangbang)

2) Jamb[munseon] and wall stud[byeokseon]

With their tenons on each upper and lower end, the jamb and wall stud are inserted in between the lintels.

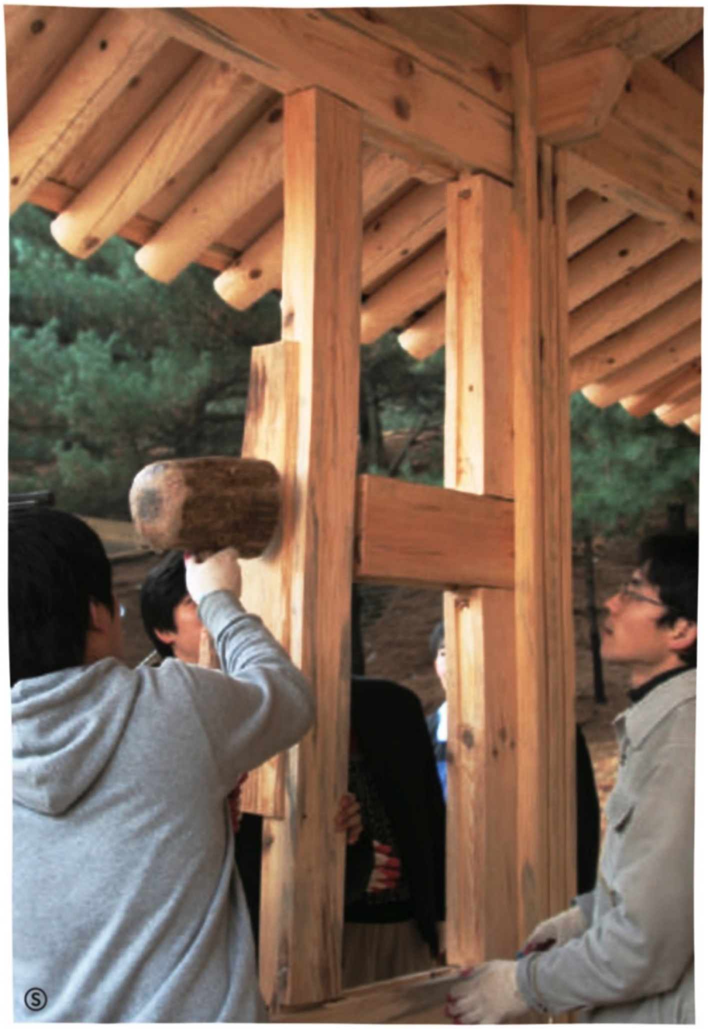
If the lintel is tightly fixed, it is hard to fit in the jamb and wall stud. Therefore, loosely fix the middle and lower lintels so that they can move when assembling the jamb and wall stud.

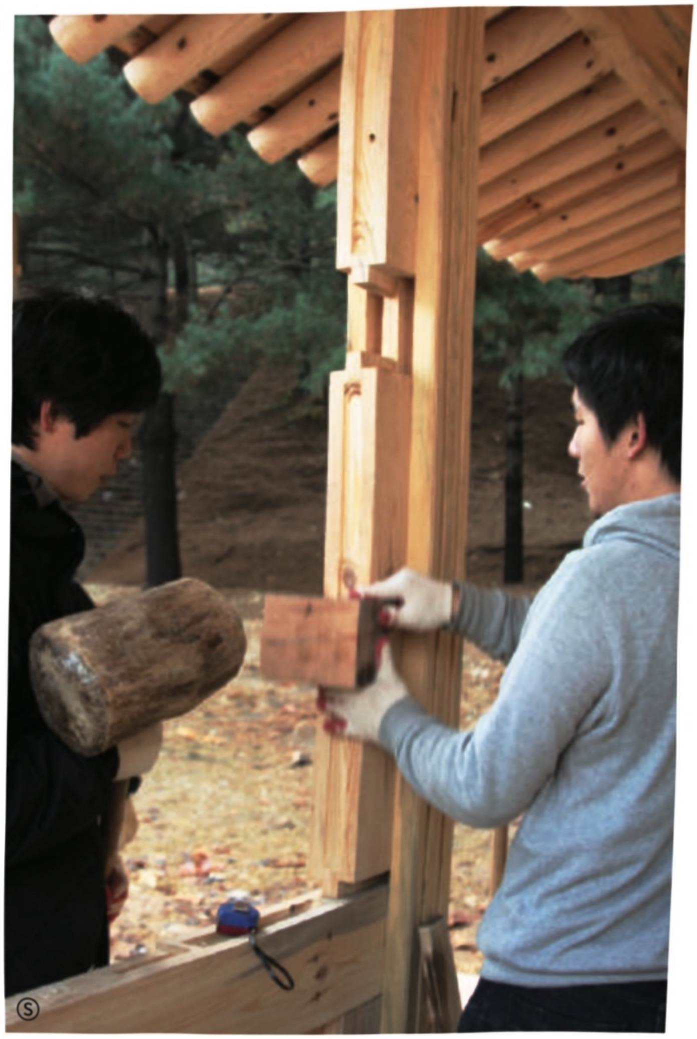
To tightly join the jamb and wall stud, hit with a mallet, but place wooden blocks in between so that the jamb and wall stud are not damaged.

After the tenons of the jamb and wall stud are fit in, raise and fix the lintel. Also hammer wedges into gaps.

Assembling wall studs

Assembling jambs


Assembling wall studs


Assembling jambs

18

Maru construction

1. Checkered wooden floor[umulmaru] timberwork

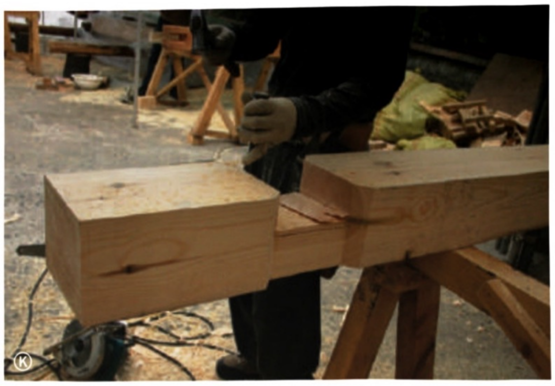
The checkered wooden floor[umulmaru] is the typical type of Maru for the Hanok. It is important for the components meeting at a right angle to sturdily interlock with each other.

1) Long floor joist[janggwiteul]

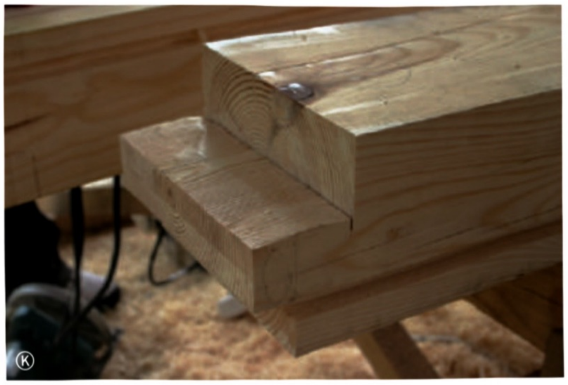
Between the long floor joists, short floor joists are placed and inserted in the same direction of the beam[bo].

Long floor joists are fitted into the column with a housed joint, so the end should be made as a tenon.

Carve the mortises for the short floor joist after checking the exact location when assembling.

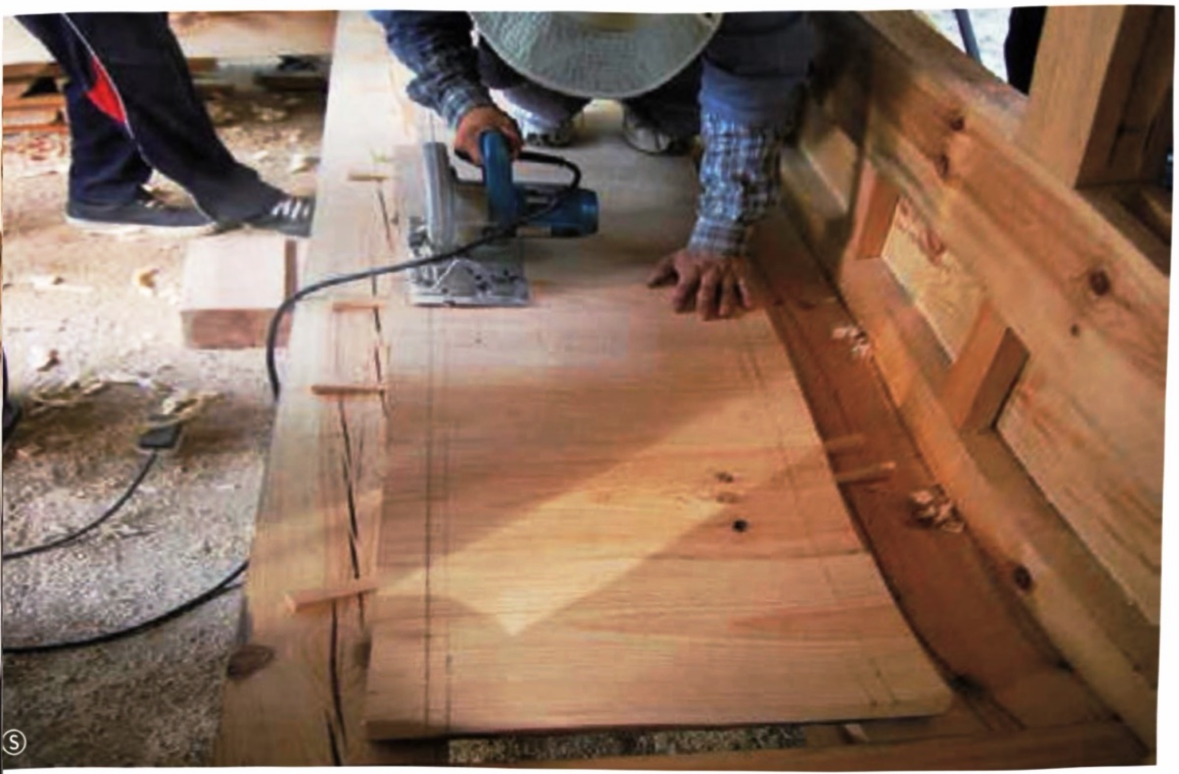


Carving mortises of the long floor joist



Carving a rabbet of the short floor joist

[illegible]



1
2
—
***Trimming* the floor boards**

2. Assembling Umulmaru

The checkered wooden floor[umulmaru] is made by placing the floor joist[gwiteul], carving mortises, and then inserting floor boards[cheongpan] between the floor joists. The shape resembles a well[umul].

1) Assembling long floor joists[janggwiteul]

Because the long floor joist is joined without any trimming into the column, it is best that the mortise in the column is shallow.

The long floor joist can be pushed in from the side if the mortise is horizontally long.

2) Assembling short floor joists[donggwiteul]

Mark where the short floor joist will be joined with the long floor joist and carve mortises. Carve to a sufficient depth considering assembly.

The short floor joist has long rabbets on the sides in order to fit in floor boards. Place them in between long floor joists in the purlin[dori] direction.

For the uniform floor pattern after assembly, make sure that the center ink line of the short floor joist is parallel to each other. After joining the short floor joists, hammer in wedges so that they do not fall apart.

3) Assembling floor boards[cheongpan]

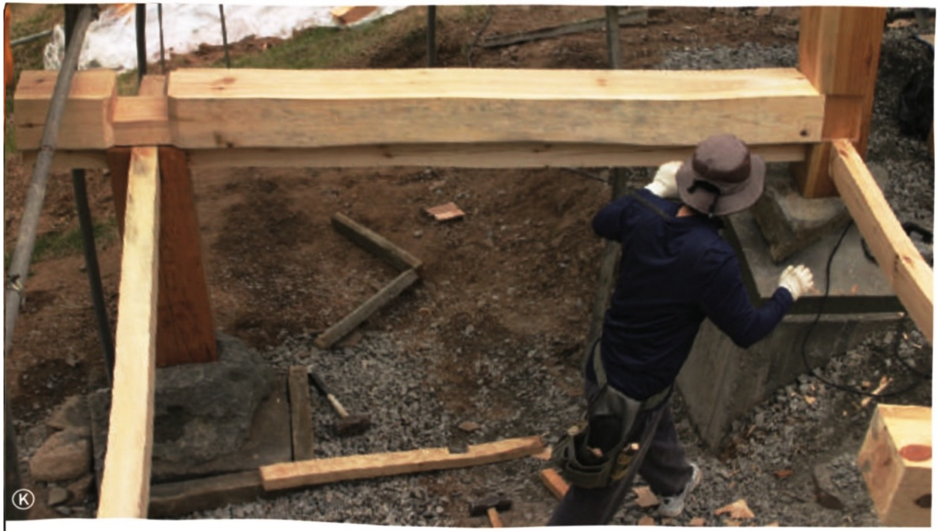
Insert and push in floor boards in numerical order from one side of the frame.

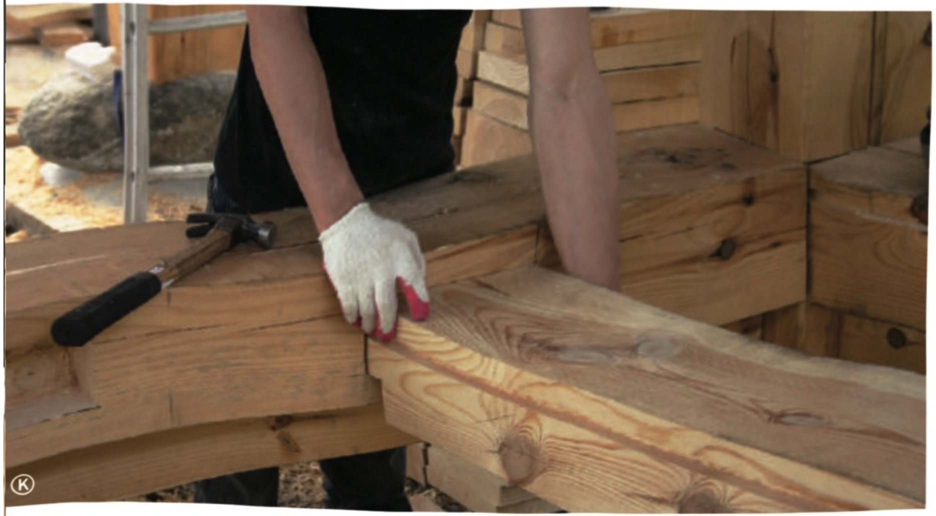
After inserting the last board, hammer in a wedge so that the boards are fixed.

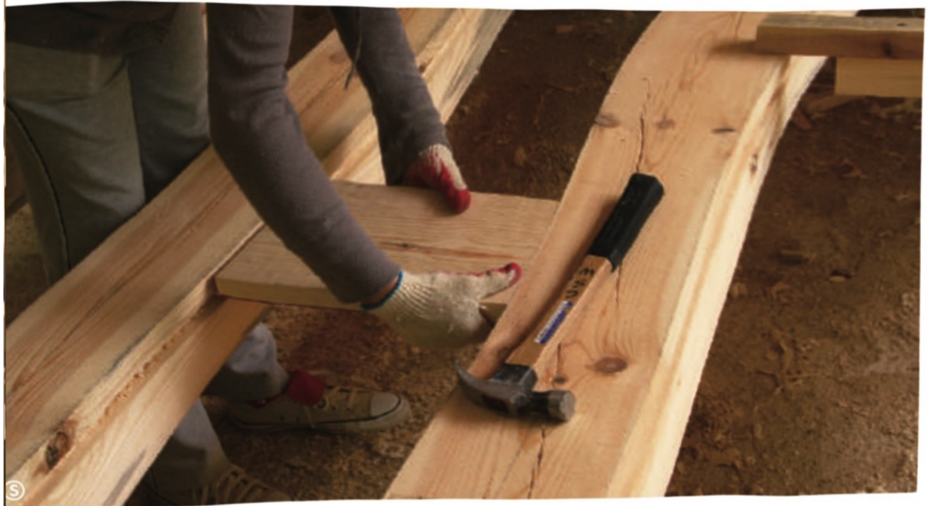
4) Smoothing Maru surface

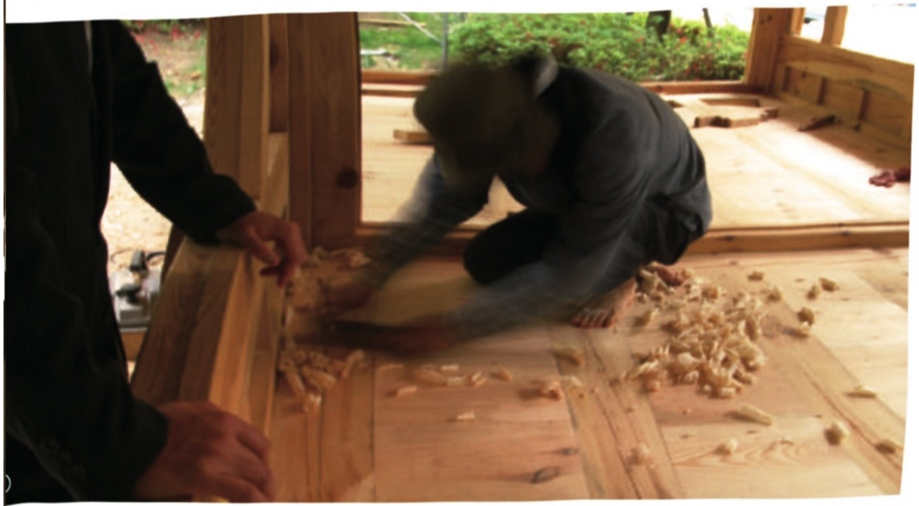
After assembly, plane the bumps to smooth the Maru surface.

Eliminate parts of the joints that do not align.









1
2
3
4

—

1 Assembling the long floor joist
2 Assembling the short floor joist
3 Assembling floor boards
4 Smoothing the Maru surface

19

Wall construction

For the traditional Hanok wall, mud is plastered on woven horizontal laths. This process is completed in several steps. First, vertical laths are installed, and horizontal laths are tied to the vertical laths with straw ropes. Then mud or lime is plastered to form the wall.

1. Wall construction - lathwork, first plaster coat for inner wall

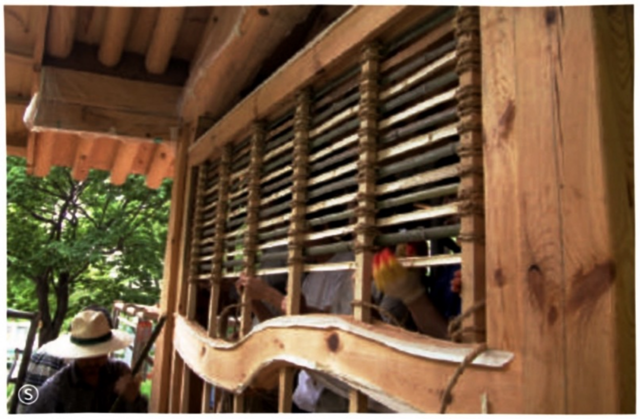
Lathwork[oeyeokgi] is the process of making the frame to apply the mud on. The first plastering[chobyeok-bareugi] is the first step of mud plastering. Mud is applied to form the innermost layer of the walls.

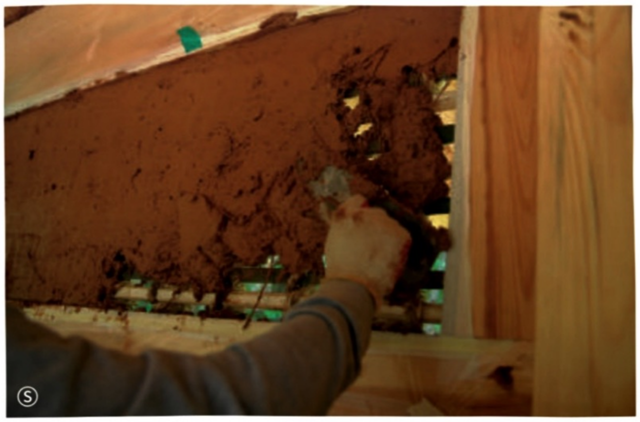
1) Lathwork[oeyeokgi]

Set up the vertical laths and tie the horizontal laths to the vertical laths with straw ropes. Straight logs or square timber is used as vertical laths and is raised in between lintels. The appropriate thickness is 1/2~1/3 of the lintel or 4~6㎝. Fit vertical laths into holes carved into the lintel and fix firmly.

The material of laths is not defined, but usually, local products are used: bamboo, bush clover strips, or sorghum strips can be utilized. However, today split bamboo is commonly used due to easier accessibility.

Thinner ribs are placed in between the main vertical and horizontal laths. Horizontal ribs that are placed across the main vertical laths are called ‘nuloe,’ and vertical ribs that are placed perpendicular to the horizontal ribs in between vertical laths are called ‘seoloe’. Tie and firmly fix in the order of vertical laths, nuloe, and seoloe. Preferably have the horizontal laths placed towards the interior when tying to vertical laths.


Lathwork


First plaster

2) First plaster[chobyeok-bareugi]

The first plaster is done with a mixture of mud, sand, finely chopped straw, and water. The first plaster mixture can be made in advance and stored for 3 days; this process will make the straw softer. Yet it is okay to mix and use on the very day. The fodder prevents the mud from cracking. The first plastering is done on the innermost wall. This is because if the plastering starts from the outer wall, the interior will be too dark when working for the interior wall. Also it would take a longer time to dry since the interior will not be well-ventilated.

For the interior wall, when applying the first coat, leave about 9mm (3pun) around the edges, considering that second coat and setting coat will be applied. For the exterior wall, apply as much mud so that it penetrates the vertical laths and sticks to the straw ropes tying the horizontal laths.

Make sure that the mud is packed into the hollow spaces on the wall frame sides.

While mud can be applied with one's hands, it is good to finish with a trowel. Scratching and making a rough surface will help when applying the second plastering.

2. Wall construction - first plaster coat for outer wall

Mud plaster the opposite side of the first plaster.

Plastering the outer wall follows the same process as the first plastering. The composition of the mud mixture is alike but uses less straw so that it adheres well to the first plastering.

Plaster the outer wall after the first plaster is fully dry. Just like the first plaster, spread out and press the mud on.

Apply to leave about 9mm (3pun) in width of the wall frame.

While mud can be applied with one's hands, it is good to finish with a trowel. Scratching and making a rough surface will help when applying the second plastering.

3. Wall construction - second plaster coat

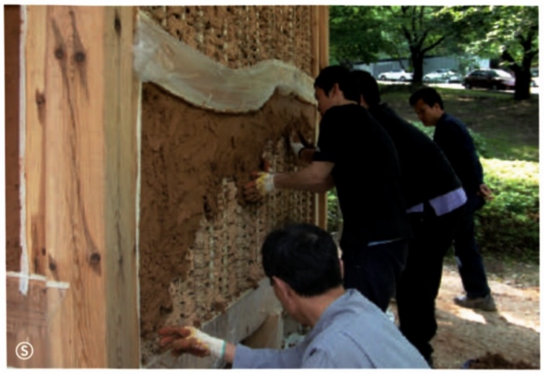
The second plaster of mud is applied on both sides of the first plastered walls.

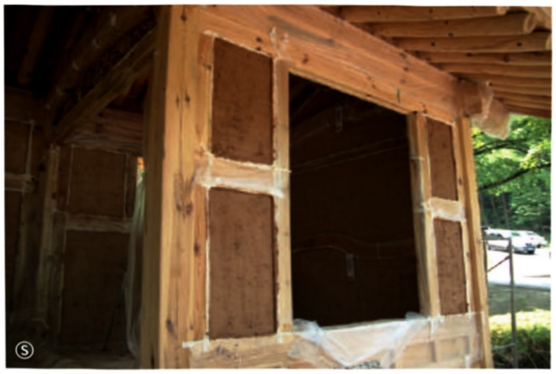
1) Dubbing out

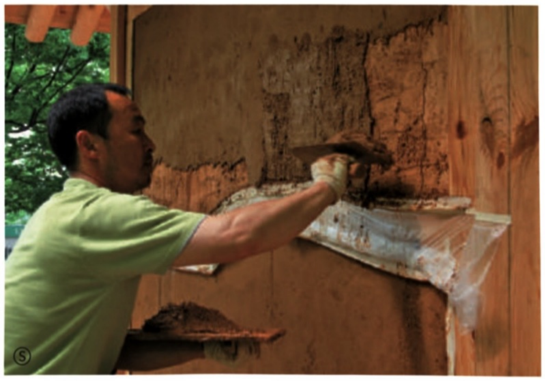
Before applying the second coat, the walls must be dubbed out. Dubbing out is the process of filling in hollow spaces, gaps, and cracks to create a smooth surface.
After dubbing out, spray water to create a good surface for the second coat.
If the first plastering has not cracked a lot, dubbing out can be skipped.

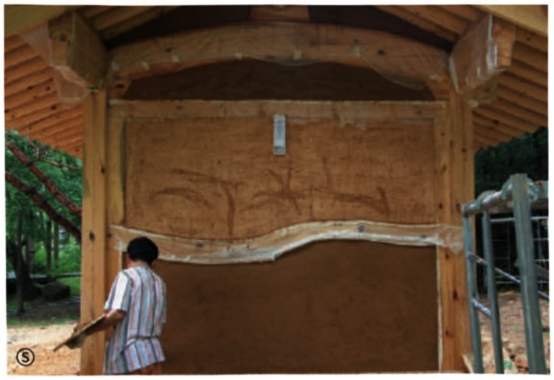
2) Second coat

The mud mixture for the second coat is similar to that of the first coat but uses finer sand, and straws should be cut into smaller pieces.
If a setting plaster is to be applied, leave about 5mm (about 1~2pun) more than the width of wall frame along the edges.
Apply evenly with a trowel and make sure not to leave trowel marks.









5 6 — **5, 6 First plaster coat**
7 8 — **7, 8 Second plaster coat**

4. Wall construction - setting plaster

The setting plaster is the last step of plastering the mud wall.

Setting plaster has two types: finishing with only lime or mixing red clay and sand. The lime-plastered wall is gray, but when using red clay and sand, the color of the wall can be adjusted by controlling the proportions.

For the setting plaster, only fine particles of red clay and sand should be used. Therefore, they should be sifted in advance. The mud for the setting plaster should be made at once so that the color is uniform throughout the wall.

Apply the setting plaster evenly with a trowel, and set in 1mm, which is the thickness of a metal trowel, from the wall frame. Smooth out and do not leave any trowel marks.

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Railing construction

The protruding railing[gyeja-nangan] and flat railing are the most widely used forms of railings.[7]

1. Timberwork

For the protruding railing[gyeja-nangan], plane the wooden boards to be 9㎝ (about 3chi) thick and trim to the size of one baluster[gyejagak].
Trace the shape of the baluster according to the blueprints and then cut and dress.
With a sculpting chisel, carve the decorations.
The railing capital[hayeob] is a small component but requires a lot of work. It has to be fixed on top of the baluster and fully support the circular shape of the handrail[dollandae].

Trimming the protruding railing

Carving the decoration on balusters

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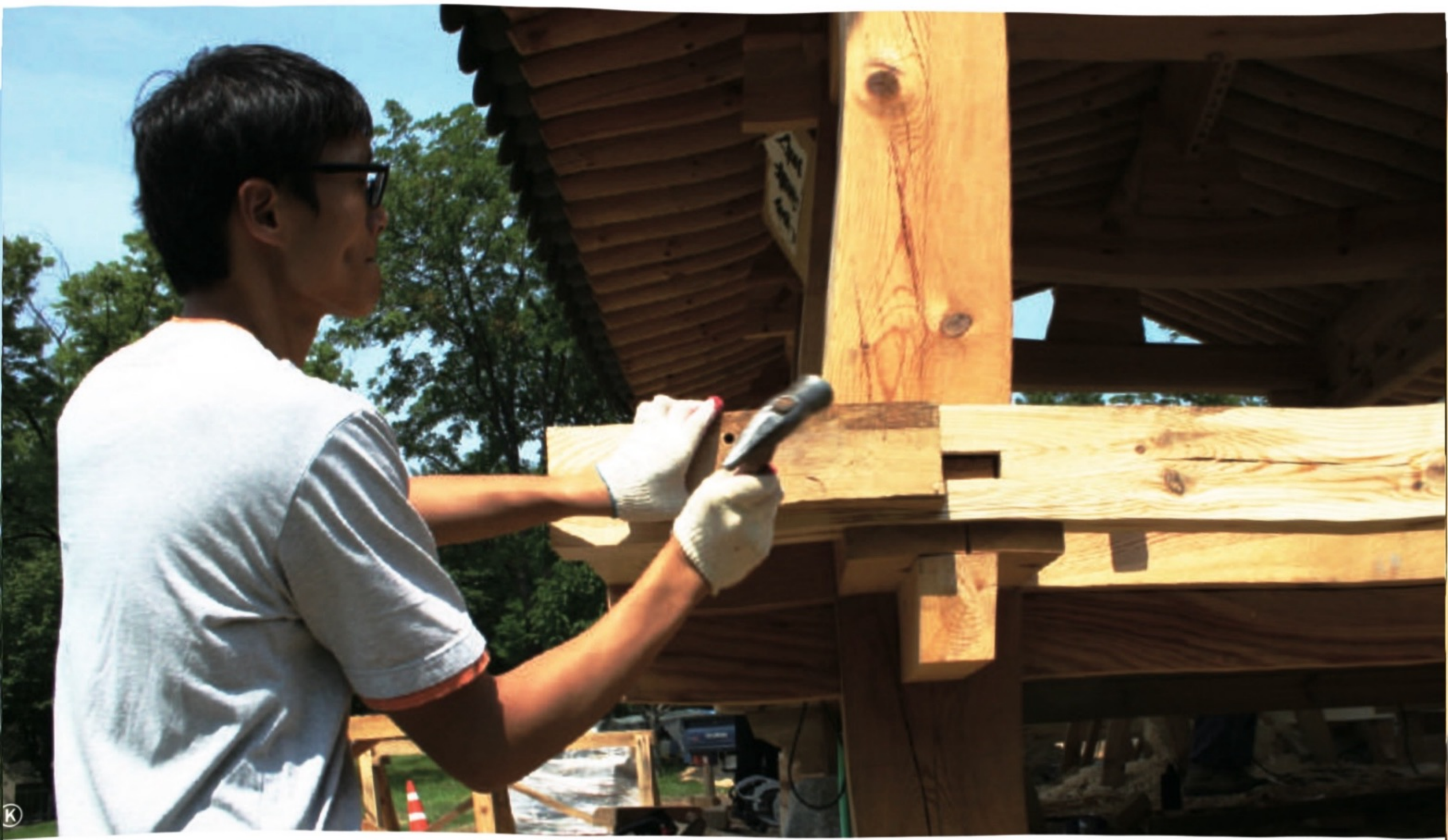
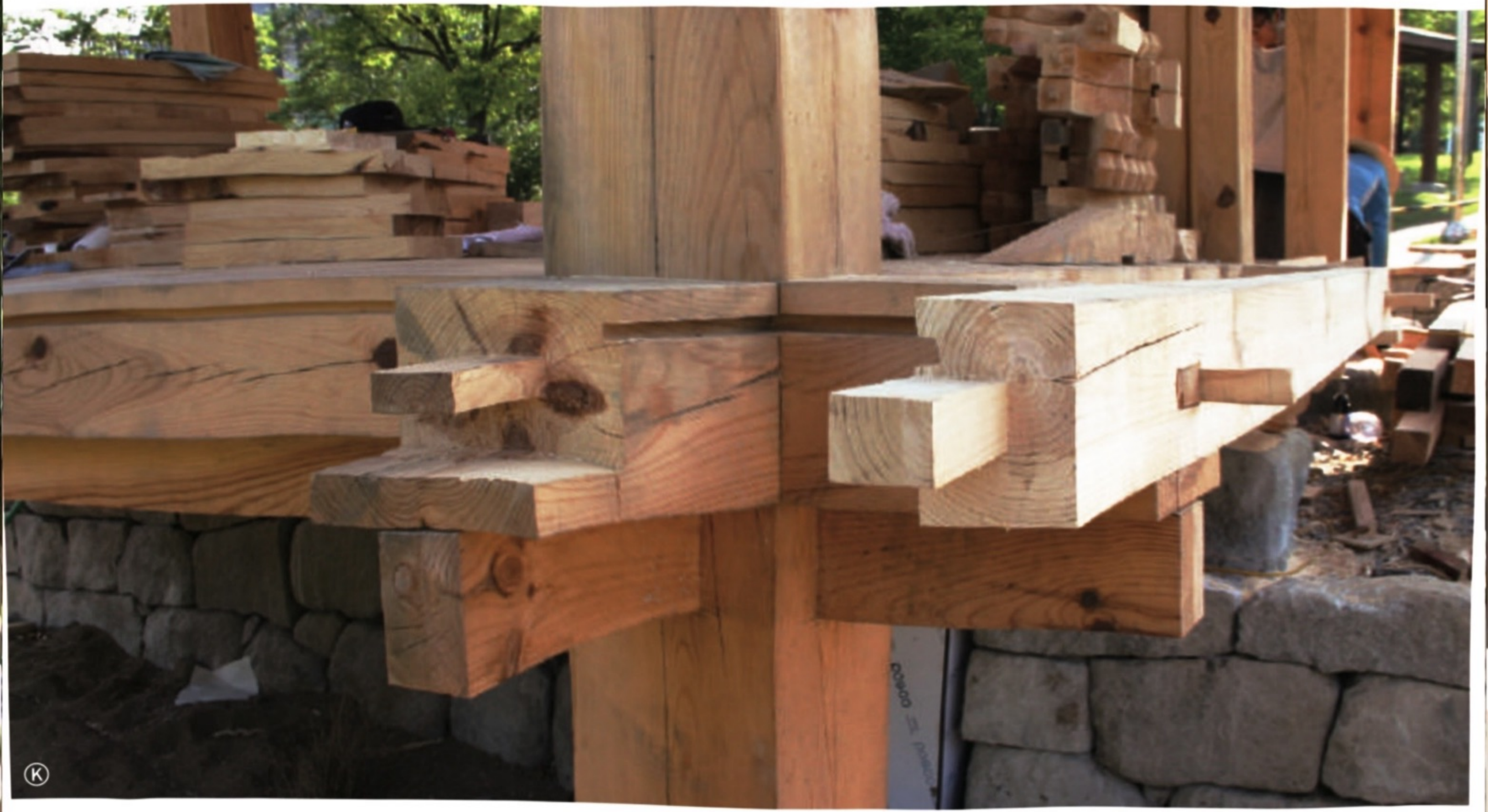
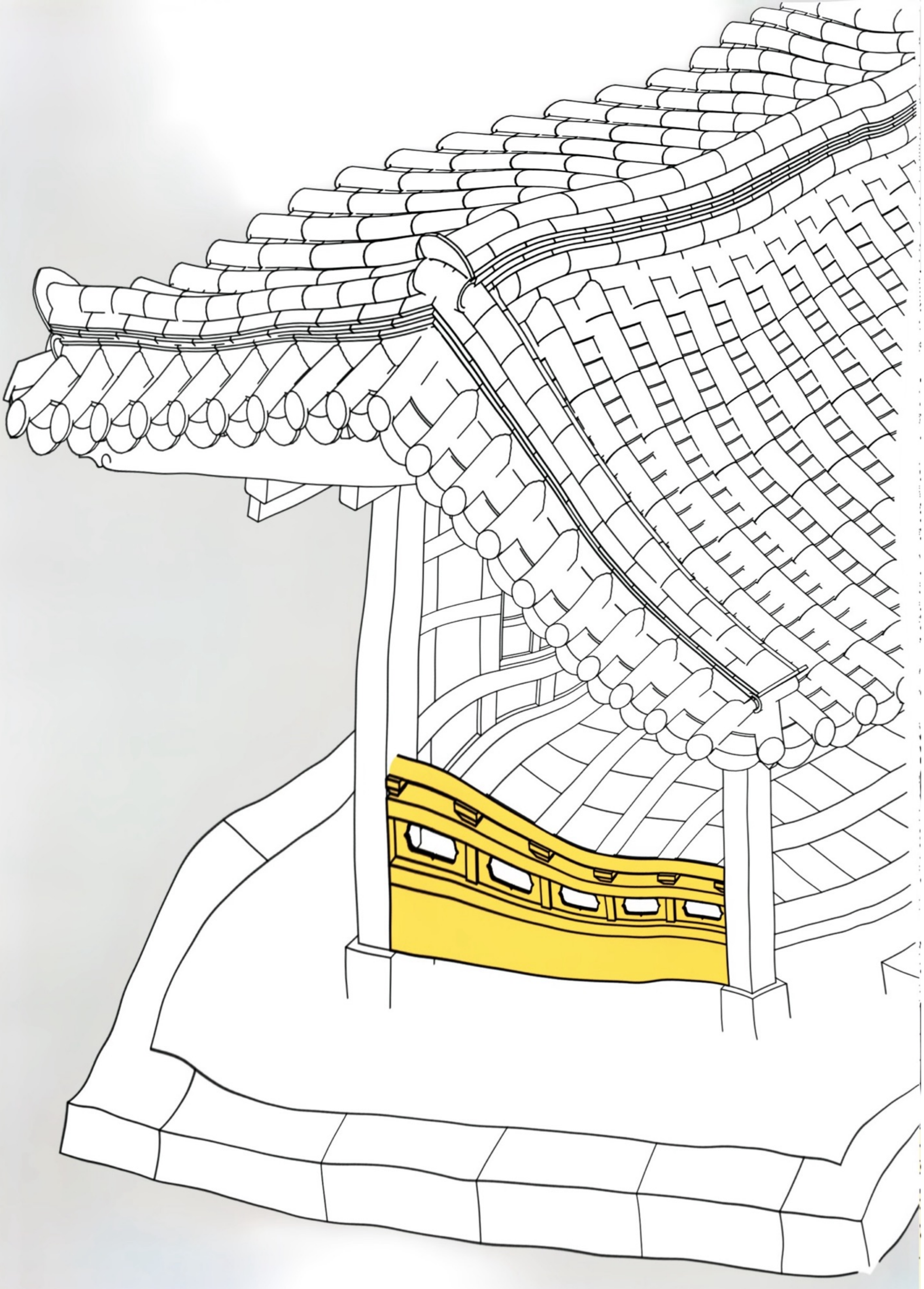
[7] Gyeja means chicken-shaped, and since the supporting columns of the protruding railing are sculpted in the shape of rooster comb, it is named gyeja. See index number 14-2 for further explanation.





1 — 1, 2 Assembling floor joists
2



21

Door and window installation

Assemble the pre-made doors and windows on the site and apply the window paper.

1. Installing doors and windows

As soon as the construction plans are completed, order the doors and windows and discuss the installment schedule. When ordering the doors and windows, the placement of window paper must be in consideration.

Temporarily assemble the doors and windows and check for errors in measurements. Normally when the wall frame is deformed, or when insufficiently planned, the measurements may be different from the blueprints.

In order to amend, check that the wall frame is leveled and perpendicular. Then plane either the door/window or the wall frame, preferably the one that needs less work. Since this is de-

12 | Installing doors and windows

tailed work requiring the millimeter correcting, it should be carried out by a skilled joiner. Today, hinges are hidden on the sides of the doors and windows, but traditionally they were exposed in the front.

2. Papering doors and windows

Decide where to cover with paper: include the sides of the doors and windows, only the back side, or up to the board.

Window paper can be either simple paper or acrylic. For long-term maintenance, layering several sheets of window paper is more effective than using only one layer. Nowadays acrylic window paper can be easily bought.

Detach the doors and windows from the building and place on the workbench.

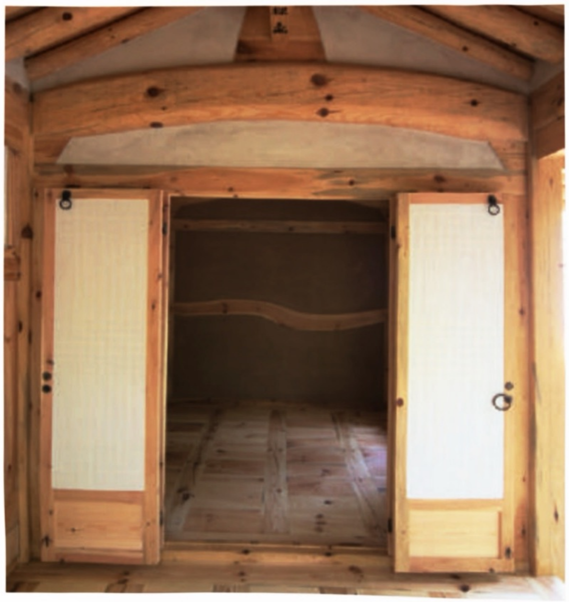
Place the window paper against the frame and trim.

Remove dust with a towel or fine brush and spray water on the frame.

After applying glue on the cross ribs of the window, attach the window paper from the top by spreading out and pressing evenly.

Check for lifted or crooked spots.

After the paper is dried, reassemble the doors and windows.



1 3 — 1 Hardwares for doors and windows
2 4 2 Installing hardwares for doors and windows
3 Papering doors and windows
4 Papering completed

22
Stylobate construction

1. Stonework

Surrounding the stylobate with border stones.

1) Placing border stones

There are two kinds of stylobates depending on what kind of stone is used: long rectangular stones 30~40㎝ in length or natural stones.

Place batter boards and suspend the reference strings. It is convenient to place the strings on the front surface of the stones along the border of the stylobate. With a multipurpose excavator, dig in a sufficient width and depth to place the stones.

Take account of the length of the stones being buried underground and the thickness of the aggregate layers that will join the stones and the ground.

Pave with a quicklime or cement mixture so that the border stones are fixed to the ground.

Place the stones along the reference strings.

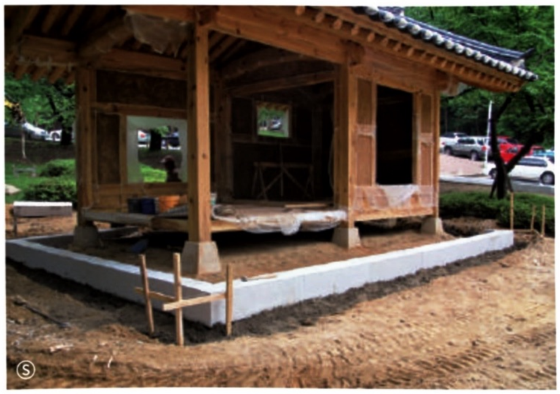
Stylobate foundation work

Placing border stones

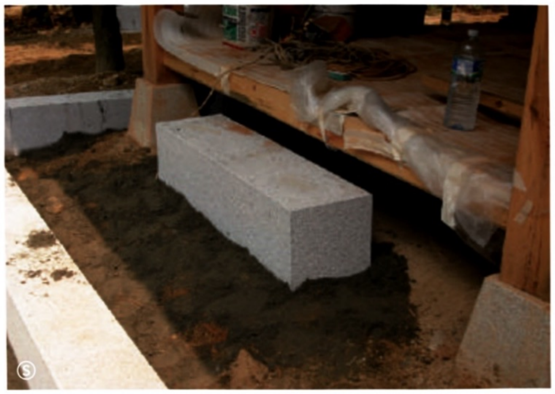
When working with processed stones, place side by side in the length direction. With natural stones, arrange by shape and size so that a stable stylobate can be formed.
The stones can be joined with or without filling materials in between.
After placing the border stones fill in the excavated ground.

2) Placing the step stones

Lay step stones alike the border stones.
Adjust the height from the bottom so that it is at an appropriate place between the stylobate and Maru.



Placing border stones



Placing the step stone

2. Plastering

After filling in the inner part surrounded by border stones, plaster neatly up to the stylobate surface.

1) Filling the stylobate

Use aggregates with larger particles for the filling material for the stylobate.
Usually the aggregates are spreaded layer by layer up to the height of the stylobate. It is recommended to ram or step on the aggregates while filling. This is because at the finishing state of construction, the aggregates do not settle on itself and because the border stones can be pushed outwards when using a compactor.
Mound aggregates slightly higher on the inner part surrounded by columns and the outer part slightly lower than the height of the stylobate. The rest will be filled with the floor finishing process.

2) Stylobate plastering

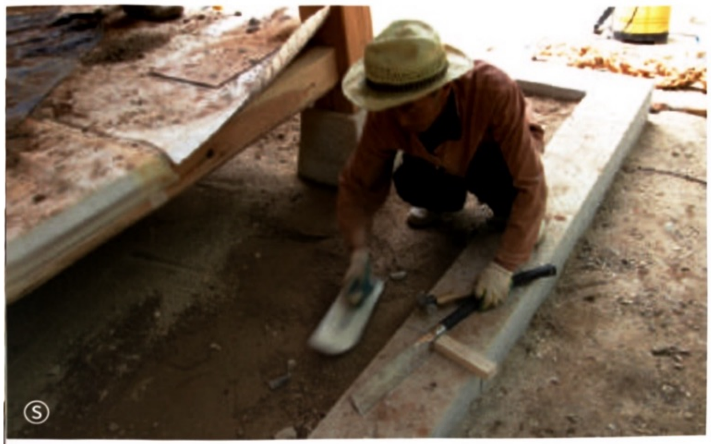
Check the floor where plaster is to be applied and carve bumps that are higher than the finishing surface.
Fill in the remaining height with a mixture of soil cement, sand, and quicklime. Harden and

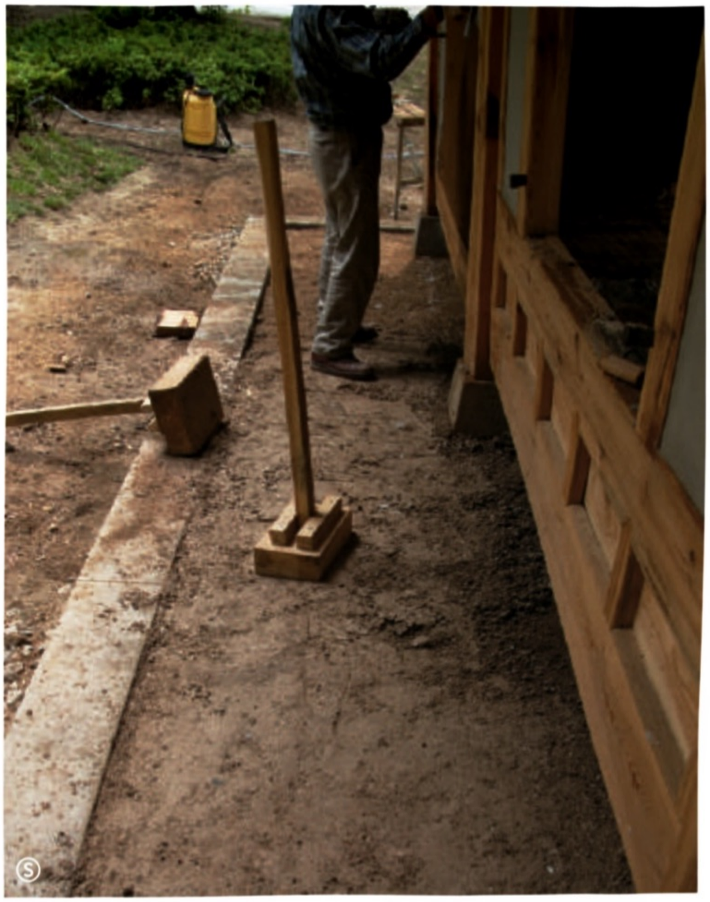
flatten out the ground with a flat rammer.

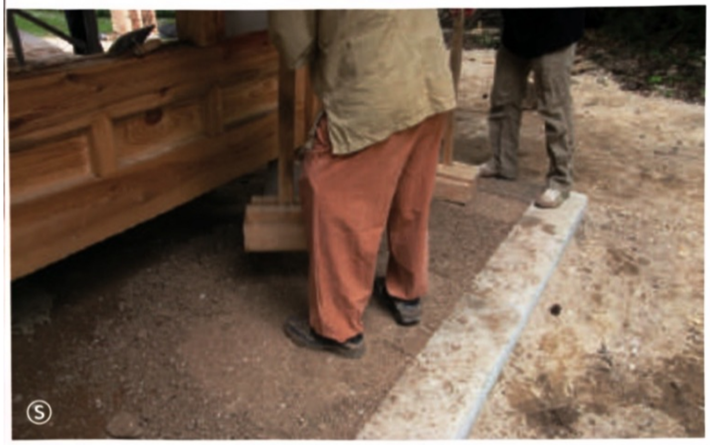
Press with a trowel to form a bulging shape.

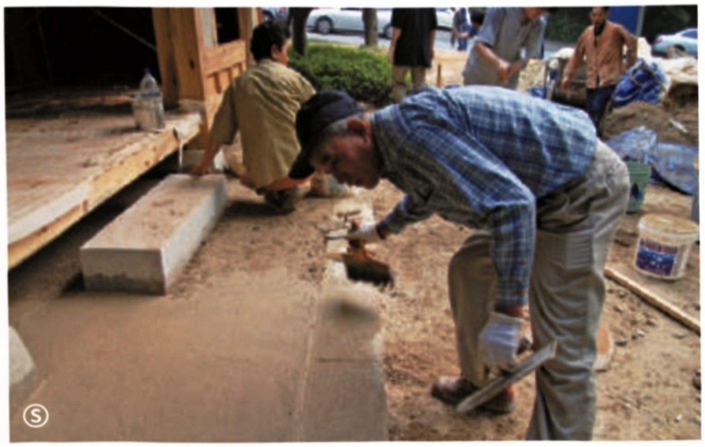
When applying plaster, use a mud mixture and drawk in water. Create a gradual slope from the columns toward the stylobate. Also have the part meeting with the border stones be at the same height so that puddles are not formed.

Once the finishing construction is completed, wipe the border stones and clean.









1 4 — 1 Leveling the ground
2 2 Ramming the ground
3 3, 4 Stylobate plastering

23

Oil coating

Applying coating materials on the surface to protect the wood and to embellish.

1. Making even surfaces

Plane and sand bumpy parts to make a smooth surface.

With a mixture of fine sawdust and glue, fill in gaps where members meet.

Fit in thin wood blocks in wider gaps.

Cure and protect joints where disparate materials meet.

Planing and sanding bumpy parts

Filling in gaps where members meet

2. Oil coating

For oil, grounded beans, perilla oil, and linseed oil are commonly used since they are vegetable oils that dry quickly.

It is better that oil coating is applied several times.

1 2 | Oil coating

24

Cleaning

Before the completion ceremony, clean the Hanok and its surroundings.

1. Cleaning waste

Before completion, the site should be cleaned.
Disassemble the temporary warehouse and clean the surroundings to its original state.
Left over aggregates can be used for the yard or garden.
Unused or recyclable materials can be kept to use for repair work later on.
Other wastes should be collected and disposed.

2. Organizing

Remove dust from the Hanok with a dry wash towel.
Spread out weathered granite or plant grass in the yard.

Cleaning dust with a dry wash towel

Waste disposal

25

Completion ceremony

The completion ceremony includes the naming ceremony and the moving-in ceremony. A signboard with the name of the Hanok is hanged, and through congratulating the completion of the Hanok, participants are appreciated for their hard work.

1. Naming ceremony [hyeonpansik]

A signboard with the name of the Hanok is hanged in the front. This ceremony is meaningful because each Hanok is usually labeled with a unique name.

Fix the signboard slantly in the middle of the main bay. It should be hung at an angle so that whoever standing in the front yard can read it.

Naming ceremony

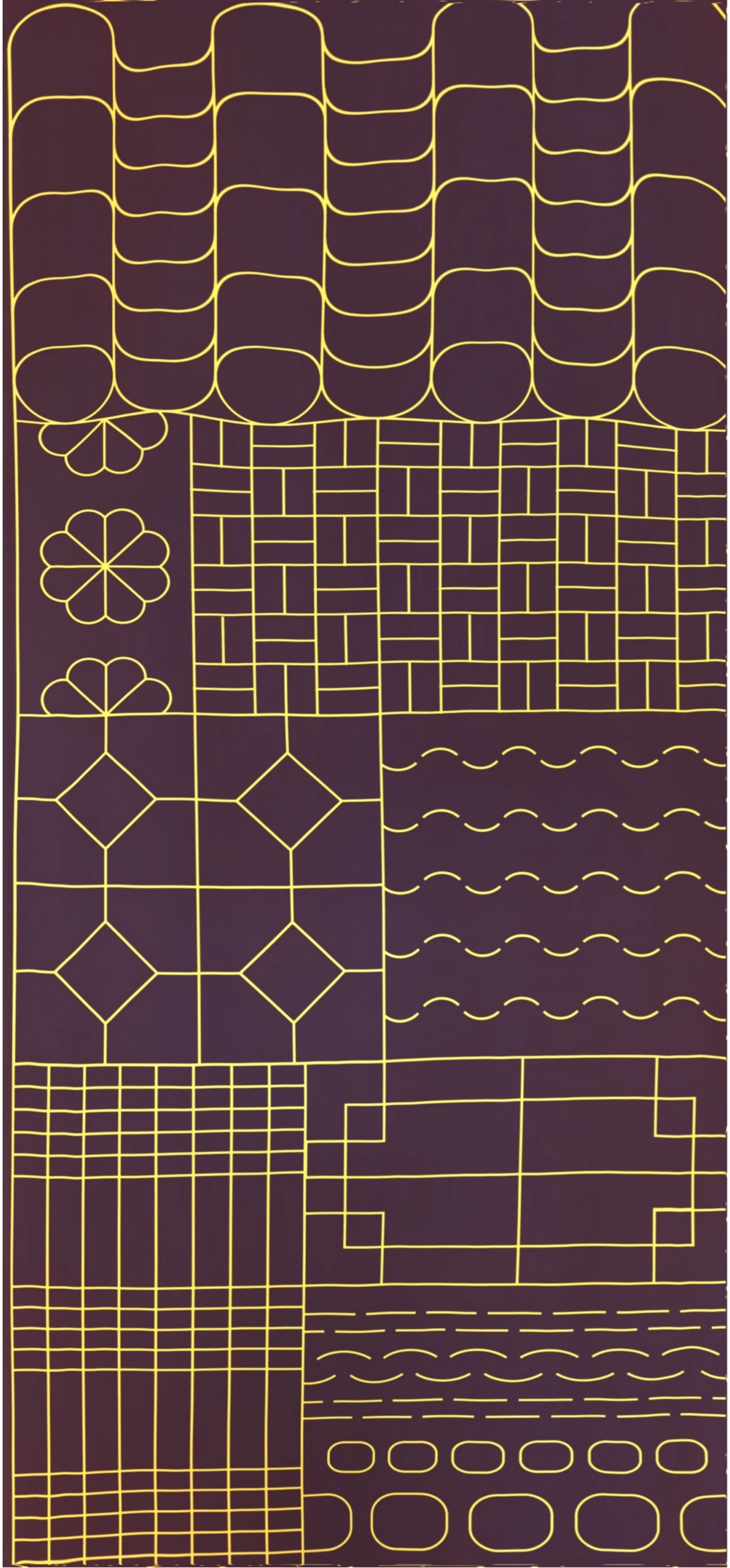
2. Moving-in ceremony [ipjusik]

Moving-in ceremony is equivalent to today's completion ceremony. The name indicates that the Hanok is completed and the owner is officially moving into the house for the first time.

The ceremony is to congratulate that the Hanok has been completed safely and to appreciate the participants for their hard work.

After the ritual ceremony, a feast is held.

Moving-in ceremony



II

Glossary of Hanok

Division	No.	Korean	Romanized	Chinese Character	English	Chinese	Japanese
Roofs & Buildings	**1**	**roof types(material)**					
	1-1	**초가지붕**	choga-jibung	草葺	thatched roof	茅草屋顶 [máocǎowūdǐng]	草葺き屋根 [くさぶきやね]
	1-2	**기와지붕**	giwa-jibung	瓦葺	tiled roof	瓦屋顶 [wǎwūdǐng]	瓦葺き屋根 [かわらぶきやね]
	2	**roof types(form)**					
	2-1	**맞배지붕**	matbae-jibung	-	gabled roof	悬山顶 [xuánshāndǐng]	切妻屋根 [きりづまやね]
	2-2	**팔작지붕**	paljak-jibung	-	hipped-and-gabled roof	歇山顶 [xiēshāndǐng]	入母屋屋根 [いりもややね]
	2-3	**우진각지붕**	wujingak-jibung	-	hipped roof	庑殿顶 [wǔdiàndǐng]	寄棟屋根 [よせむねやね]
	3	**planar modules**					
	3-1	**칸**	kan	間	bay	间[jiān]	間[けん]
	3-2	**정칸 (어칸)**	jeongkan (eokan)	正間 (御間)	core bay	明间[míngjiān]	中央間 [ちゅうおうま]
	3-3	**협칸**	hyeopkan	夾間	side bay	次间[cìjiān]	脇間[わきま]
	3-4	**퇴칸**	toekan	退間	half-sized side bay	稍间[shāojiān]	庇[ひさし] 隅間[すみま]
	4	**sectional structure**					
	4-1	**량가**	ryangga	梁架	purlin structure	-	-
	5	**building types**					
	5-1	**안채**	anchae	-	main house	-	奥座敷 [おくざしき]
	5-2	**사랑채**	sarangchae	-	detached house	-	表座敷 [おもてざしき]
	5-3	**문간채**	munganchae	-	gate building	-	長屋門 [ながやもん]
	5-4	**회랑**	hoerang	回廊	gallery	回廊[huíláng]	回廊[かいろう]
	5-5	**전각**	jeongak	殿閣	royal palace	殿阁[diàngé]	殿堂[でんどう]
	5-6	**정자**	jeongja	亭子	pavilion	亭子[tíngzi]	東屋[あづまや]
Components	**6**	**기단**	gidan	基壇	stylobate	台基[táijī]	基壇[きだん]
	6-1	**월대**	woldae	月臺	large stylobate around building	月台[yuètái]	月台[げつだい]
	6-2	**토축기단**	tochuk-gidan	土築基壇	earthen stylobate	夯土台基 [hāngtǔtáijī]	土壇[どだん]
	6-3	**전축기단**	jeonchuk-gidan	塼築基壇	brick stylobate	砖砌台基 [zhuānqìtáijī]	塼積基壇 [せんせききだん]
	6-4	**자연석기단**	jayeonseok-gidan	自然石基壇	natural stone stylobate	天然石台基 [tiānránshítáijī]	野面積基壇 [のづらづみきだん]
	6-5	**장대석기단**	jangdaeseok-gidan	長臺石基壇	rectangular stone stylobate	条石砌台基 [tiáoshíqìtáijī]	切石布積み基壇 [きりいしぬのづみきだん]

Division	No.	Korean	Romanized	Chinese Character	English	Chinese	Japanese
Components	**6-6**	**혼합식기단**	honhapsik-gidan	混合式基壇	mixed stylobate		-
	7	**초석**	choseok	礎石	column base stone	柱础[zhùchǔ]	礎石[そせき]
	7-1	**자연석초석**	jayeonseok-choseok	自然石礎石	natural-shaped column base stone	天然石柱础 [tiānrán-shízhùchǔ]	自然石礎石 [しぜんせきそせき]
	7-2	**원형초석**	wonhyeong-choseok	圓形礎石	round-shaped column base stone	圆形柱础 [yuánxíng-zhùchǔ]	圓形礎石 [えんけいそせき]
	7-3	**방형초석**	banghyeong-choseok	方形礎石	square-shaped column base stone	方形柱础 [fāngxíngzhùchǔ]	方形礎石 [ほうけいそせき]
	7-4	**장주초석**	jangju-choseok	長柱礎石	tall column base stone	-	-
	8	**기둥**	gidung	柱	column	柱[zhù]	柱[はしら]
	8-1	**민흘림기둥**	minheulrim-gidung	-	tapered column	-	-
	8-2	**배흘림기둥**	baeheulrim-gidung	-	entasis column	梭柱[suōzhù]	胴張り柱 [どうばりはしら]
	8-3	**평주**	pyeongju	平柱	common column	檐柱[yánzhù], 外柱[wàizhù]	柱[はしら]
	8-4	**고주**	goju	高柱	tall column	金柱[jīnzhù], 内柱[nèizhù]	建登せ柱 [たてのぼせばしら]
	8-5	**우주**	wuju	隅柱	corner column	角柱 [jiǎozhù]	隅柱 [すみばしら]
	8-6	**활주**	hwalju	活柱	angle rafters supporting column	擎檐柱 [qíngyánzhù]	軒支柱 [のきじちゅう]
	8-7	**동자주**	dongjaju	童子柱	short column on beam	蜀柱[shǔzhù], 瓜柱[guāzhù]	束柱 [つかばしら]
	9	**공포**	gongpo	栱包	bracket set	斗拱 [dǒugǒng]	斗拱[ときょう] 組物[くみもの]
	9-1	**다포식**	daposik	多包式	structure type with multi-bracket set	-	詰組 [つめぐみ] 禪宗様 [ぜんしゅうよう]
	9-2	**주심포식**	jusimposik	柱心包式	structure type with simple bracket set	-	疎組 [あまぐみ] 和様 [わよう]
	9-3	**익공식**	ikgongsik	翼工式	structure type with bird's wing shaped bracket arm	-	-
	9-4	**민도리식**	mindorisik	-	structure type without bracket set	-	-

Division	No.	Korean	Romanized	Chinese Character	English	Chinese	Japanese
Components	**10**	**가구**	gagu	架構	frame structure	梁架[liángjià]	架構[かこう] 骨組構造[ほねぐみこうぞう]
	10-1	**보아지**	boaji	樑奉, 甫兒只	beam supports	丁斗栱[dīngdòugǒng], 插栱[chāgǒng]	木鼻[きばな]
	10-2	**창방**	changbang	昌枋	column connecting beam	阑额[láné], 额枋[éfāng]	頭貫[かしらぬき]
	10-3	**평방**	pyeongbang	平枋	bracket set supporting beam	普拍枋[pǔpāifāng], 平板枋[píngbǎnfāng]	台輪[だいわ]
	10-4	**보**	bo	梁	beam	梁[liáng]	梁[はり]
	10-5	**대공**	daegong	臺工	truss post	駝峯[tuófēng], 脊瓜柱[jǐguāzhù]	束[つか]
	10-6	**장여**	jangyeo	長舌	purlin supports	替木[tìmù]	肘木[ひじき]
	10-7	**도리**	dori	桁	purlin	榑[tuàn], 桁[héng], 檩[lǐn]	桁[けた]
	11	**지붕**	jibung	-	roof	屋顶[wūdǐng]	屋根[やね]
	11-1	**처마**	cheoma	-	eaves	屋檐[wūyán]	軒[のき]
	11-2	**서까래**	seokkarae	椽木	rafters	椽[chuán]	垂木[たるき]
	11-3	**추녀**	chunyeo	春舌	angle rafters	大角梁[dàjiǎoliáng], 老角梁[lǎojiǎoliáng]	隅木[すみぎ]
	11-4	**평고대**	pyeonggodae	平交臺, 平高臺	laths on rafters	小连檐[xiǎoliányán]	木負[きおい]
	11-5	**개판**	gaepan	蓋板	shingle	望板[wàngbǎn]	野地板[のじいた]
	11-6	**박공**	bakgong	欂栱	barge board	博风板[bófēngbǎn], 博缝板[bóféngbǎn]	破風[はふ]
	11-7	**적심**	jeoksim	積心	roof filling wood	-	下葺き材[したぶきざい]
	11-8	**보토**	boto	補土	roof filling soil	苫背[shànbèi]	葺土[ふきつち]
	11-9	**연함**	yeonham	椽檻	pan tile supporting laths	瓦口[wǎkǒu]	瓦座[かわらざ]
	11-10	**기와**	giwa	瓦	roof tile	瓦[wǎ]	瓦[がわら]
	11-11	**용마루**	yongmaru	-	ridge of a roof	正脊[zhèngjǐ]	大棟[おおむね]
	12	**온돌**	ondol	溫突	Ondol	火炕[huǒkàng]	温突[オンドル]
	12-1	**구들**	gudle	炕	Gudeul	-	-

Division	No.	Korean	Romanized	Chinese Character	English	Chinese	Japanese
Components	13	마루	maru	抹樓, 廳	Maru	木地板 [mùdìbǎn]	板床[いたゆか] 板敷[いたじき]
	13-1	귀틀	gwiteul	耳機	floor joist	-	根太[ねだ]
	13-2	청판	cheongpan	廳板	floor board	-	床板[ゆかいた]
	14	난간	nangan	欄干	railing	栏杆[lángān]	高欄[こうらん]
	14-1	평난간	pyeong-nangan	平欄干	flat railing	-	-
	14-2	계자난간	gyeja-nangan	鷄子欄干	protruding railing	-	-
	15	수장재	sujangjae	修粧材	wall frame components	装修[zhuāngxiū]	意匠材 [いしょうざい]
	15-1	인방	inbang	引枋	lintel	槛[kǎn]	貫[ぬき]
	15-2	머름	meoreum	遠音	wainscot	-	腰板 [こしいた]
	15-3	벽선	byeokseon	壁楦	wall stud	抱框 [bàokuàng]	方立 [ほうだて]
	15-4	문선	munseon	門楦	jamb	大边 [dàbiān]	幣軸 [へいじく]
Techniques	16	터잡기	teo-japgi	-	choosing site	选址[xuǎnzhǐ]	土地を決める [とちをきめる] 占地[せんち]
	16-1	터	teo	-	site	基址[jīzhǐ]	敷地[しきち]
	16-2	풍수	pungsu	風水	Feng Shui	堪舆[kānyú], 风水[fēngshuǐ]	風水[ふうすい]
	16-3	복거	bokgeo	卜居	location	卜居[bojū]	卜居[ぼっきょ]
	16-4	좌향	jwahyang	坐向	orientation	朝向[cháoxiàng]	向き[むき]
	17	지정	jijeong	地定	building foundation	基础[jīchǔ]	地業[じぎょう]
	17-1	달구질	dalgujil	-	rammering	夯土 [hāngtǔtáijī]	地固め [じがため]
	17-2	모래지정	morae-jijeong	-	sand foundation	-	砂地業 [すなじぎょう]
	17-3	장대석 지정	jangdaeseok-jijeong	長臺石 地定	rectangular stone foundation	-	切石地業 [きりいしじぎょう]
	17-4	적심석 지정	jeoksimseok-jijeong	積心石 地定	grave foundation	-	割栗地業 [わりくりじぎょう]
	17-5	생석회 잡석지정	saengseokhoe-japseok-jijeong	生石灰 雜石地定	quicklime foundation	-	石灰地業 [せっかいじぎょう]
	18	정초	jeongcho	定礎	laying column base stone	-	定礎[ていそ]
	18-1	실 띄우기	sil-ttuiwugi	-	stretching cord	弹线[tánxiàn]	水盛り遣り方 [みずもりやりかた]

Division	No.	Korean	Romanized	Chinese Character	English	Chinese	Japanese
Techniques	**19**	**치목**	chimok	治木	timberwork	荒料[huāngliào]	木材加工 [もくざいかこう]
	19-1	**마름질**	mareumjil	-	cutting timber	打截料[dǎjiéliào]	玉切り[たまきり]
	19-2	**바심질**	basimjil	-	dressing timber	砍刨[kǎnbào]	木取り[きどり]
	19-3	**가심질**	gasimjil	-	trimming timber	凿眼整齐 [záoyǎnzhěngqí]	仕上げ[しあげ]
	19-4	**그레질**	geurejil	-	fitting for connection	-	光付け [ひかりつけ]
	20	**결구**	gyulgu	結構	joinery	结构[jiégòu]	納まり [おさまり]
	20-1	**맞춤**	matchum	-	cross joint	榫卯[sǔnmǎo]	仕口[しぐち]
	20-2	**이음**	ieum	-	longitudinal joint	-	継手[つぎて]
	20-3	**쪽매**	jjokmae	-	floor joint	-	矧[はぎ]
	20-4	**장부**	jangbu	-	tenon	榫[sǔn]	枘[ほぞ]
	20-5	**턱**	teok	-	cheek	鼻子[bízi]	顎[あご]
	21	**입주**	ipju	立柱	erecting column	-	柱立て [ばしらだて]
	21-1	**다림보기**	darim-bogi	-	checking verticality	吊直拔正 [diàozhíbázhèng]	下げ振りで垂直を確認する[さげふりですいちょくをかくにんする] 縦水[たちみず]
	22	**수장**	sujang	修粧	plastering wall	-	左官工事 [さかんこうじ]
	22-1	**외역기**	oeyeokgi	-	raising the lattices	-	小舞掻き [こまいかき]
	22-2	**초벽바르기**	chobyeok-bareugi	-	first plastering	-	荒壁塗り [あらかべぬり]
	22-3	**맞벽바르기**	matbyeok-bareugi	-	outer wall first plastering	-	裏返し塗り [うらがえしぬり]
	22-4	**고름질**	goreumjil	-	dubbing out	-	斑直し [むらなおし]
	22-5	**재벽바르기**	jaebyeok-bareugi	-	second plastering	-	中塗り[なかぬり]
	22-6	**정벌바르기**	jeongbeol-bareugi	-	setting plaster	-	上塗り[うわぬり]
	23	**마감**	magam	-	finishing	-	仕上げ[しあげ]
	23-1	**단청**	dancheong	丹青	paintwork	彩画[cǎihuà]	彩色[さいしき]
	23-2	**기름 먹이기**	gireum-meogigi	-	oil coating	-	油性塗料塗り [ゆうせいとりょうぬり]

Division	No.	Korean	Romanized	Chinese Character	English	Chinese	Japanese
Tools	24	**모탕**	motang	隅湯	pallet block	垫木[diànmù]	台木[だいぎ]
	25	**도행판**	dohaengpan	圖行板	carpenter's construction drawing	风水罗盘 [fēngshuǐluópán]	板図[いたず]
	26	**대패**	daepae	鐴	plane	刨子[bàozi]	鉋[かんな]
	27	**끌**	kkeul	鋧	chisel	凿子[záozi]	鑿[のみ]
	28	**다림추**	darimchu	錘	plumb bob	铅锤[qiānchuí]	下げ振り [さげふり]
	29	**메**	me	鈉	mallet	木锤[mùchuí]	掛矢[かけや]
Ceremonies	30	**개토제**	gaetoje	開土祭	ground-breaking ceremony	破土仪式 [pòtǔyíshì]	地鎮祭 [じちんさい,とこしづめのまつり]
	30-1	**고유문**	goyumun	告由文	ground-breaking letter	-	祝詞[のりと]
	31	**모탕고사**	motang-gosa	隅湯告祀	timberwork starting ceremony	-	安全祈願祭 [あんぜんきがんさい]
	32	**입주식**	ipjusik	立柱式	column erecting ceremony	-	立柱式 [りっちゅうしき]
	33	**상량식**	sangryangsik	上梁式	framework completion ceremony	上梁仪式 [shàngliángyíshì]	上棟式 [じょうとうしき]
	33-1	**상량문**	sangryangmun	上梁文	framework completion letter	上梁祭文 [shàngliáng-jìwén]	棟札 [むなふだ]
	34	**준공식**	jungongsik	竣工式	completion ceremony	竣工典礼 [jùngōngdiǎnlǐ]	竣工式 [しゅんこうしき]

Editor: Jeon, BongHee / Lee, Geauchul
English Translator: Hong, Soo hwa / Chae, Uri
Chinese Translator: Cha, Ju-hwan / Hyun Seung Wook
Japanese Translator: Kim, Min-Suk

01

roof types(materials)

지붕종류(재료) / 屋顶类型(材料)[wūdǐnglèixíng(cáiliào)] / 屋根材[やねざい]

❶ thatched roof[choga-jibung]
초가지붕[草葺] / 茅草屋顶[máocǎowūdǐng] / 草葺き屋根[くさぶきやね]

❷ tiled roof[giwa-jibung]
기와지붕[瓦葺] / 瓦屋顶[wǎwūdǐng] / 瓦葺き屋根[かわらぶきやね]

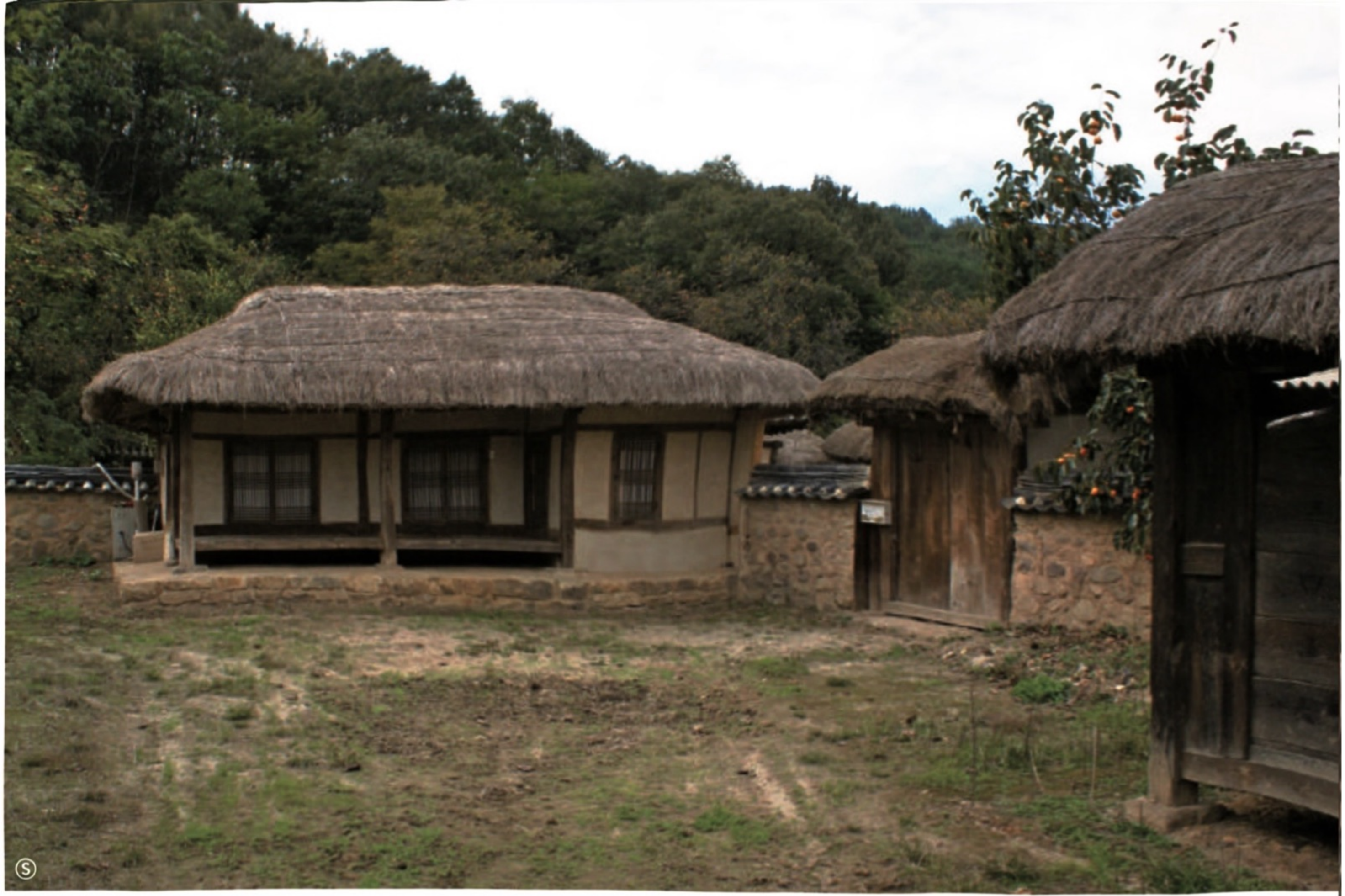
First impression of Hanok highly depends on the type and size of a roof because the roof being of great importance shows both structural and aesthetical characteristics of each Hanok. To describe Hanok, technical terms indicating the materials or shape of roofs are commonly used together with those showing sectional or planar composition. Two main materials covering the roof of Hanok are rice straws and tiles called giwa.

1. thatched roof[choga-jibung]

Thatched roof[choga-jibung] was commonly used among ordinary people's houses. It is made of woven rice straws which were abundant every year after harvesting season. To make this type of roof, thin lattice sticks are tied to the rafters to create the base surface. Then, mud mixed with fodders is spread out on that surface, and woven rice straws are placed above. These rice straws might be blown by wind, so they should be interwoven with straw ropes to the house's timber frame thoroughly.

2. tiled roof[giwa-jibung]

Tiled roof[giwa-jibung] refers to the roof tiled with tiles made of earth. In the past, this type of roof was popular for palaces or temples of higher authority and wealthy family houses. The traditional tiles made of earth are great for fire-resistance or water-tightness; however, they are quite heavy that the structural frame of Hanok should be sturdy. There are several types of roof tiles according to their shape and use.(See 11-10 giwa for further information)



Thatched roof

02

roof types(form)

지붕종류(형태) / 屋顶类型(形态)[wūdǐnglèixíng(xíngtài)] / 屋根形状[やねけいぞう]

❶ gabled roof[matbae-jibung]
맞배지붕 / 悬山顶[xuánshāndǐng] / 切妻屋根[きりづまやね]

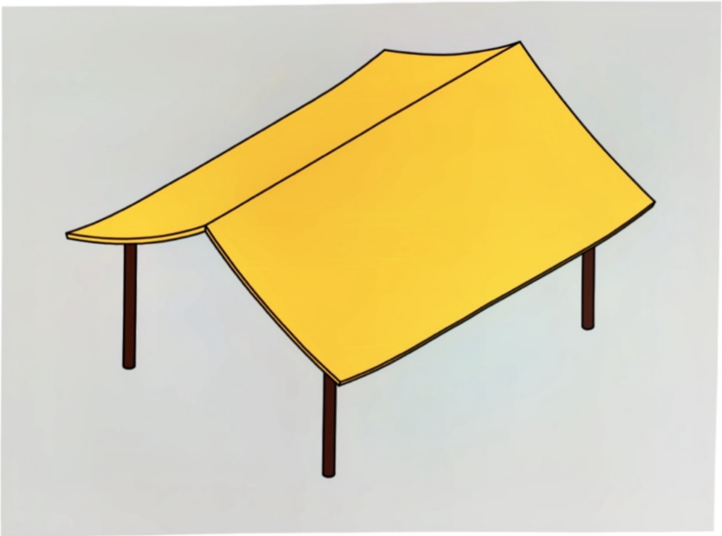
❷ hipped-and-gabled roof[paljak-jibung]
팔작지붕 / 歇山顶[xiēshāndǐng] / 入母屋屋根[いりもややね]

❸ hipped roof[wujingak-jibung]
우진각지붕 / 庑殿顶[wǔdiàndǐng] / 寄棟屋根[よせむねやね]

Contrary to the thatched roofs, a form of tiled roofs often shows the hierarchy and typical characteristics as its constructional complexity differs. This kind of distinction is also used in other countries as well. There are three main types in this category: gabled, hipped, and hipped-and-gabled. According to its name, we can visually imagine what the roof looks like.

1. gabled roof[matbae-jibung]

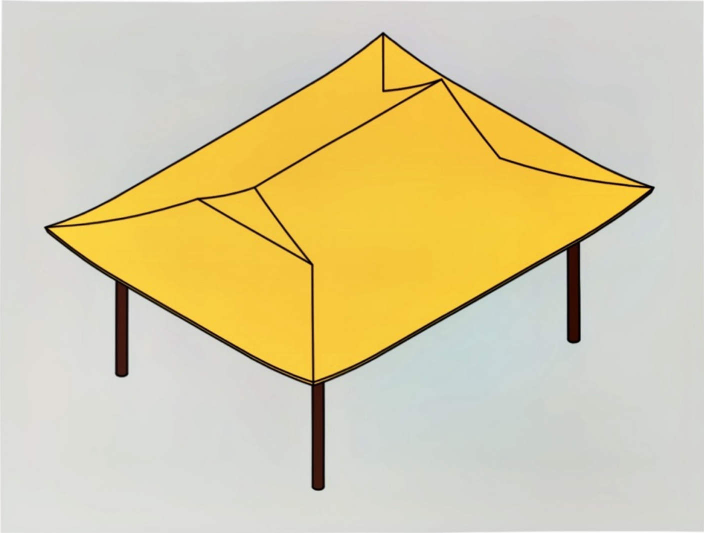
Gabled roof[matbae-jibung] is a simple gabled roof with only two front and back roof surfaces covering the house. This type of roof does not use angle rafters called chunyeo. The gabled roof is easy to construct, but it is vulnerable to the rain and wind in its sides so that the sides should be covered with barge boards or the roof needs to be long enough to create the buffer zone.



Gabled roof

2. hipped-and-gabled roof [paljak-jibung]

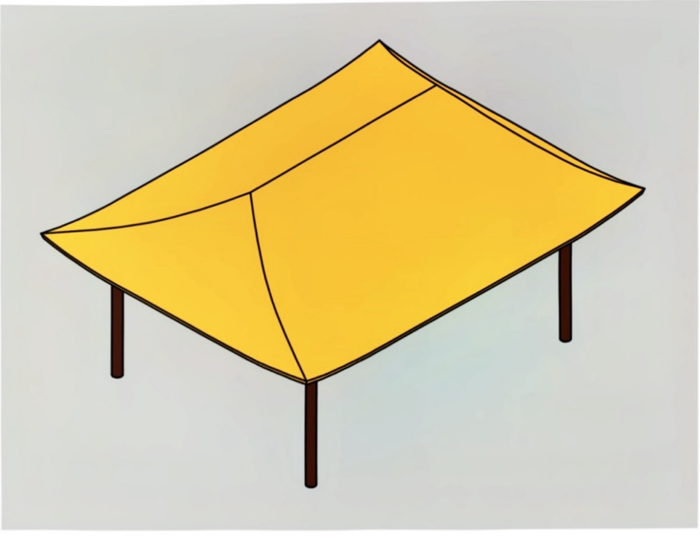
Hipped-and-gabled roof[paljak-jibung] is a hybrid type of gabled roof and hipped roof. This is the most complicated type among the roofs of Hanok. To create the hipped-and-gabled roof, three different roof ridges are required: a ridge[yongmaru], a ridge on gable[naerimmaru], a ridge on angle rafters[chunyeomaru].



Hipped-and-gabled roof

3. hipped roof [wujingak-jibung]

Hipped roof[wujingak-jibung] has four roof surfaces: front and back surfaces in trapezoid shapes and side surfaces in triangular shapes. Most of the thatched roofs are hipped roofs, but for the architecture of authority in Korea, this type was rarely used while in case of China, it is the opposite.



Hipped roof

03

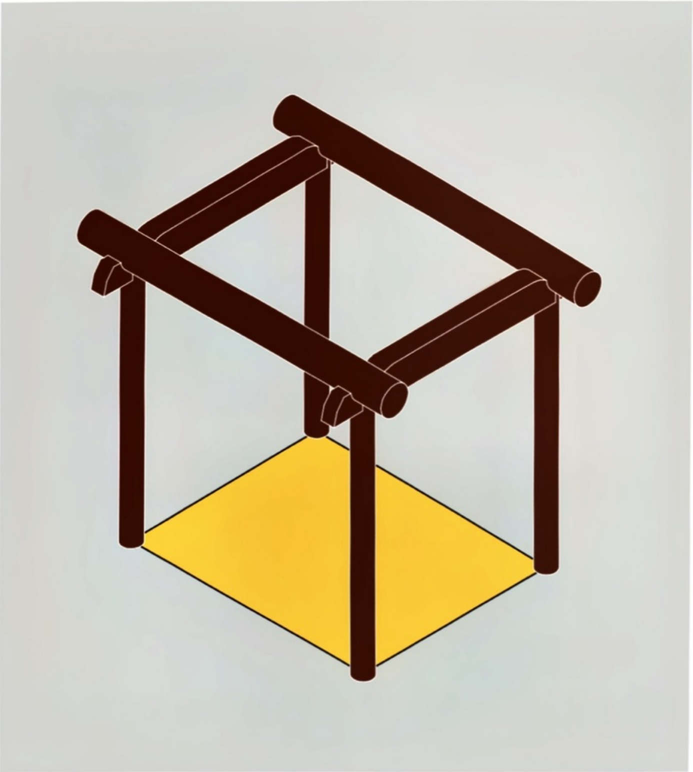
planar modules-bay[kan]

평면 모듈-칸[間] / 间[jiān] / 間[けん]

❶ core bay[jeongkan(eokan)]
정칸(어칸)[正間(御間)] / 明间[míngjiān] / 中央間[ちゅうおうま]

❷ side bay[hyeopkan]
협칸[夾間] / 次间[cìjiān] / 脇間[わきま]

❸ half-sized side bay[toekan]
퇴칸[退間] / 稍间[shāojiān] / 庇[ひさし], 隅間[すみま]



Bay

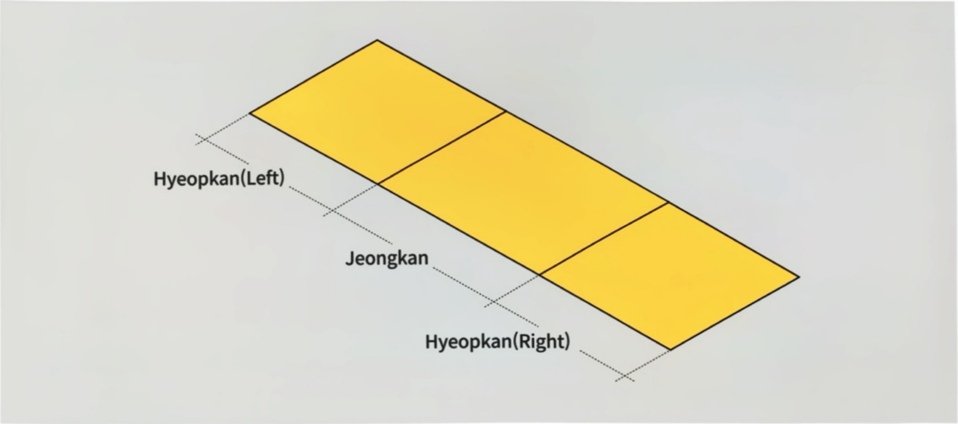
Plans of Hanok are composed of rectangular modules called kan. 'Kan(bay)' is the length or area unit used for identifying the size of Hanok. Because the Hanok frame is composed of columns, beams, and purlins, the number and arrangement of the columns reflects the size of the Hanok. The bay as a length unit refers to the distance between two parallel columns. Due to the limitation in the length of timber, one bay is usually around 8ja(about 2.4m)~12ja(about 3.6m). One bay as an area unit refers to the rectangular space the size of one bay by one bay. Accordingly, when a Hanok is three bays in length and one bay in depth, the area size is three bays. In the past, there were restrictions to the size of the Hanok that one could build according to their social class.

1. core bay[jeongkan, eokan]

Core bay[jeongkan] refers to the bay located in the center of the front or side. Usually, the core bay[jeongkan] is larger than other bays to emphasize the frontality of the Hanok. For palaces, the core bay was called the eokan in which the character 'eo' means 'ruling over'.

2. side bay[hyeopkan]

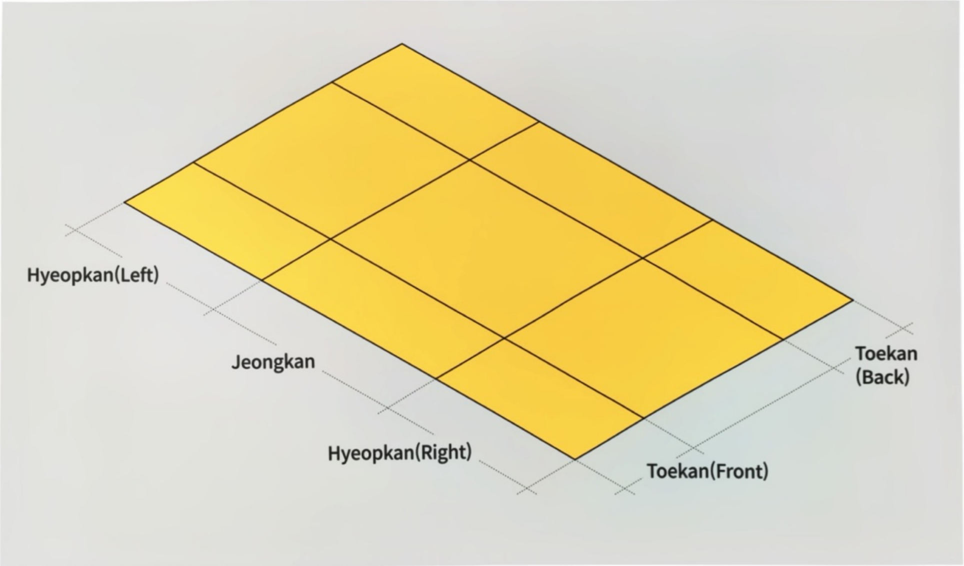
Side bay[hyeopkan] refers to the bay on each side of the core bay[jeongkan]. When the Hanok is facing south, the east side bay is the left side bay[hyeopkan] and the west side bay the right side bay[hyeopkan].


Hyeopkan(Left)
Jeongkan
Hyeopkan(Right)

Composition of 3bay × 1bay

3. half-sized side bay[toekan]

Half-sized side bay[toekan] particularly refers to side bay[hyeopkan] that is half size in width.


Hyeopkan(Left)
Jeongkan
Hyeopkan(Right)
Toekan (Back)
Toekan(Front)

Composition of 3bay × 3bay

04

sectional structure

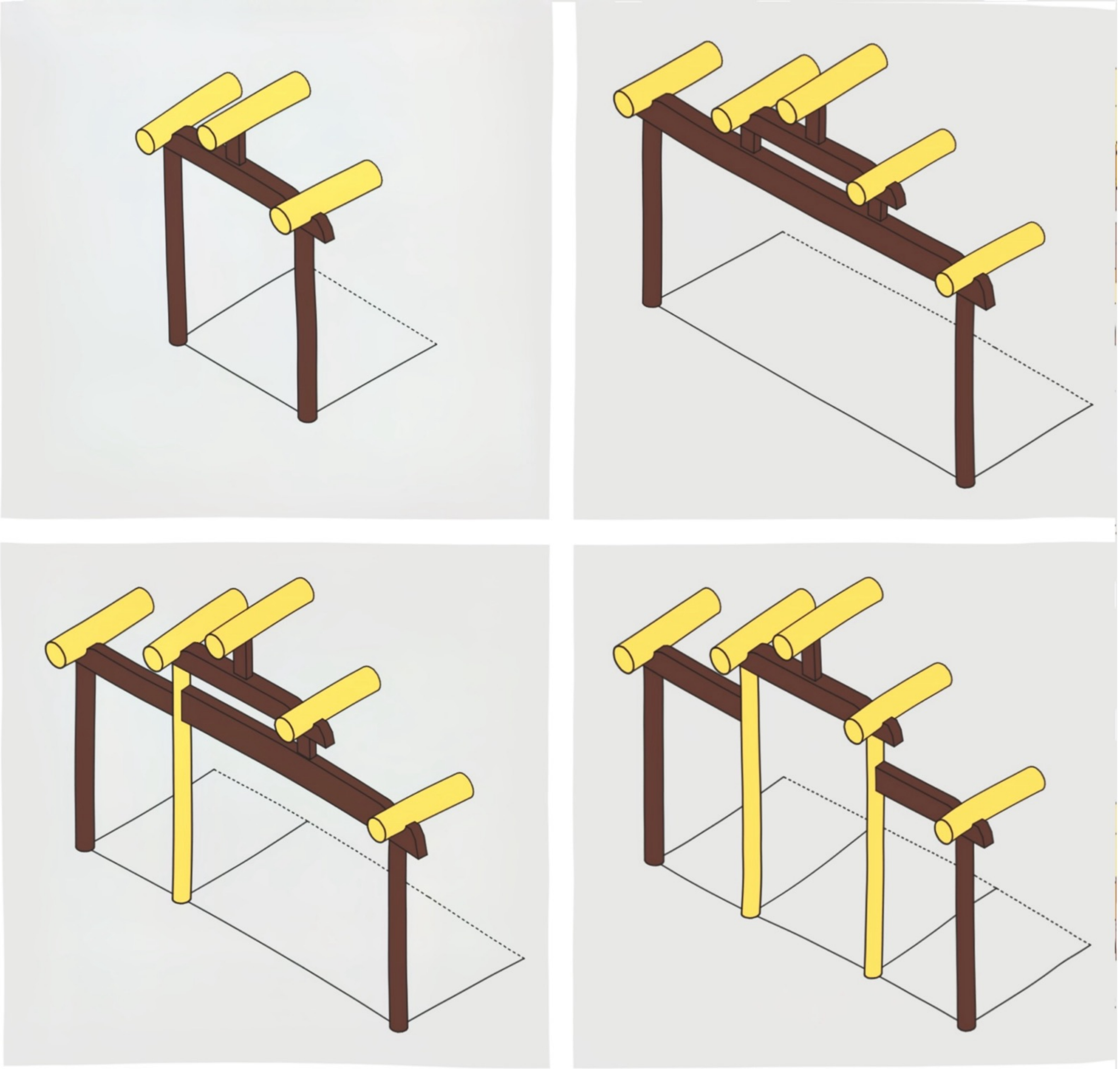
단면 구조 / 剖面结构[pōumiànjiégòu] / 架構[かこう], 断面構造[だんめんこうぞう]

❶ purlin structure[ryangga]
량가[梁架] / —— / ——

Sections of Hanok show the structural frame of it in detail. Since the structural frame of Hanok is quite complicated as many different components are used, the number of purlins is first counted to describe the general composition and size of Hanok.

purlin structure[ryangga]

Purlin structure[ryangga] indicates the type of the gagu, planar size in kans, and the sectional size of the Hanok. Sectionally, Hanok is categorized into 3-ryangga, 5-ryangga, 7-ryangga, 9-ryangga depending on the number of dori. 3-ryangga is the smallest unit forming the pitched roof of the Hanok. It is composed of two purlins on additional row of bracket arm[chulmokdori], one top purlin[jongdori], the main beam[daedeulbo], and the truss post[daegong]. Moreover, when there are tall columns[goju], the size of the Hanok is signified with both quantities of tall columns[goju] and purlin structure[ryangga] such as 1-goju 5-ryangga.



1 2 — 1 3-ryangga structure 2 5-ryangga structure

05

building types

건물 종류 / 建筑类型[jiànzhùlèixíng] / 建築種類[けんちくしゅるい]

❶ **main house**[anchae]
안채 / —— / 奥座敷[おくざしき]

❷ **detached house**[sarangchae]
사랑채 / —— / 表座敷[おもてざしき]

❸ **gate building**[munganchae]
문간채 / —— / 長屋門[ながやもん]

❹ **gallery**[hoerang]
회랑[回廊] / 回廊[huíláng] / 回廊[かいろう]

❺ **royal palace**[jeongak]
전각[殿閣] / 殿阁[diàngé] / 殿堂[でんどう]

❻ **pavilion**[jeongja]
정자[亭子] / 亭子[tíngzi] / 東屋[あづまや]

Hanok's building types are mostly categorized according to the program or function of Hanok. Usually, Hanoks compose a complex with several buildings, each titled with a certain name to describe the function or the location within the complex. There are a number of building types, ranging from not only dwelling houses for common people or a royal family, but also religious or government buildings, including a royal palace[jeongak], a temple hall[sachal], a government office[gwanah], a Confucian temple[hyanggyo], or a pavilion[jeongja]. In this section, only representative types are selected and introduced to describe a general Hanok.

1. gate building[munganchae]

Gate building[munganchae] is a building in which the main gate is placed. This gate building not only contains the gate, but also serves as storages or small rooms for animals and servants. The size and composition of the gate building vary in each Hanok.

Gate Building

2. gallery[hoerang]

Gallery[hoerang] indicates a gallery placed in the sides of main buildings of Hanok and is often used as a passageway. Usually, it is composed of only roofs and columns, without walls to be open space. The width of this gallery is generally one bay[kan].

3. royal palace[jeongak]

Royal palace[jeongak] either refers to a royal palace where the king and his family live or a big-scale building showing higher hierarchy in palaces or temples. Also, it can be a collective term indicating both a palace and a multi-storied Hanok.

4. main house[anchae]

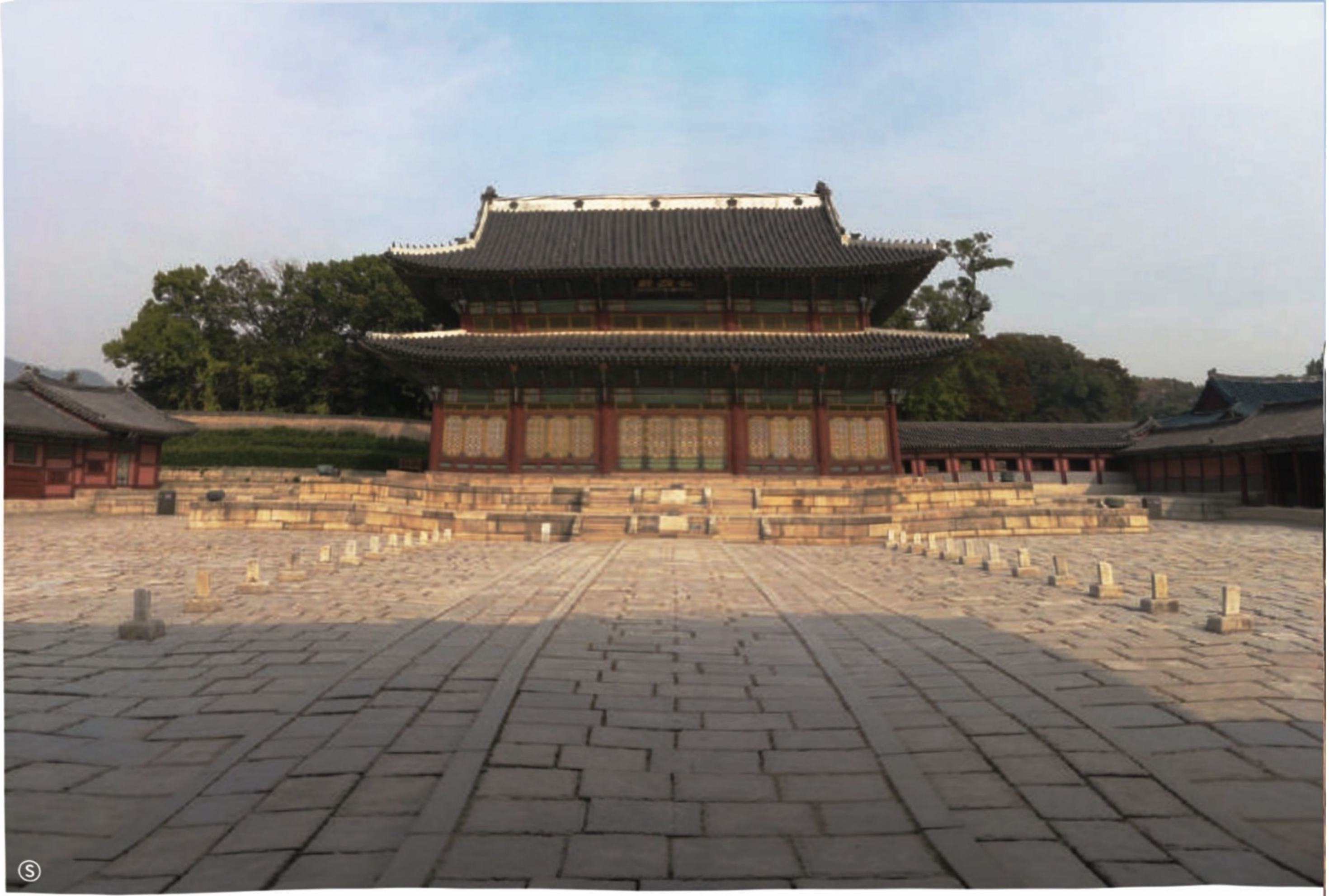
Main house[anchae] refers to the main quarters for the family and where women usually stayed. It was a private area for only family members that guests could not easily enter this quarter. Main house[anchae] is usually located in the back of the complex.

5. detached house[sarangchae]

Detached house[sarangchae] is translated as detached house, but it mainly refers to the detached quarters in which upper class men reside. Here, men would typically receive guests and supervise all of the housework so that detached house[sarangchae] is usually located in the front among many buildings forming a complex.

6. pavilion[jeongja]

Pavilion[jeongja] is a small pavilion, usually located within scenic nature to enjoy the views and take a rest. The roof of pavilion[jeongja] shows several types, including square hipped roof, hexagonal, or octagonal roofs.



Royal palace

Detached house

06

stylobate[gidan]

기단[基壇] / 台基[táijī] / 基壇[きだん]

❶ large stylobate in front of building[woldae]
월대[月臺] / 月台[yuètái] / 月台[げつだい]

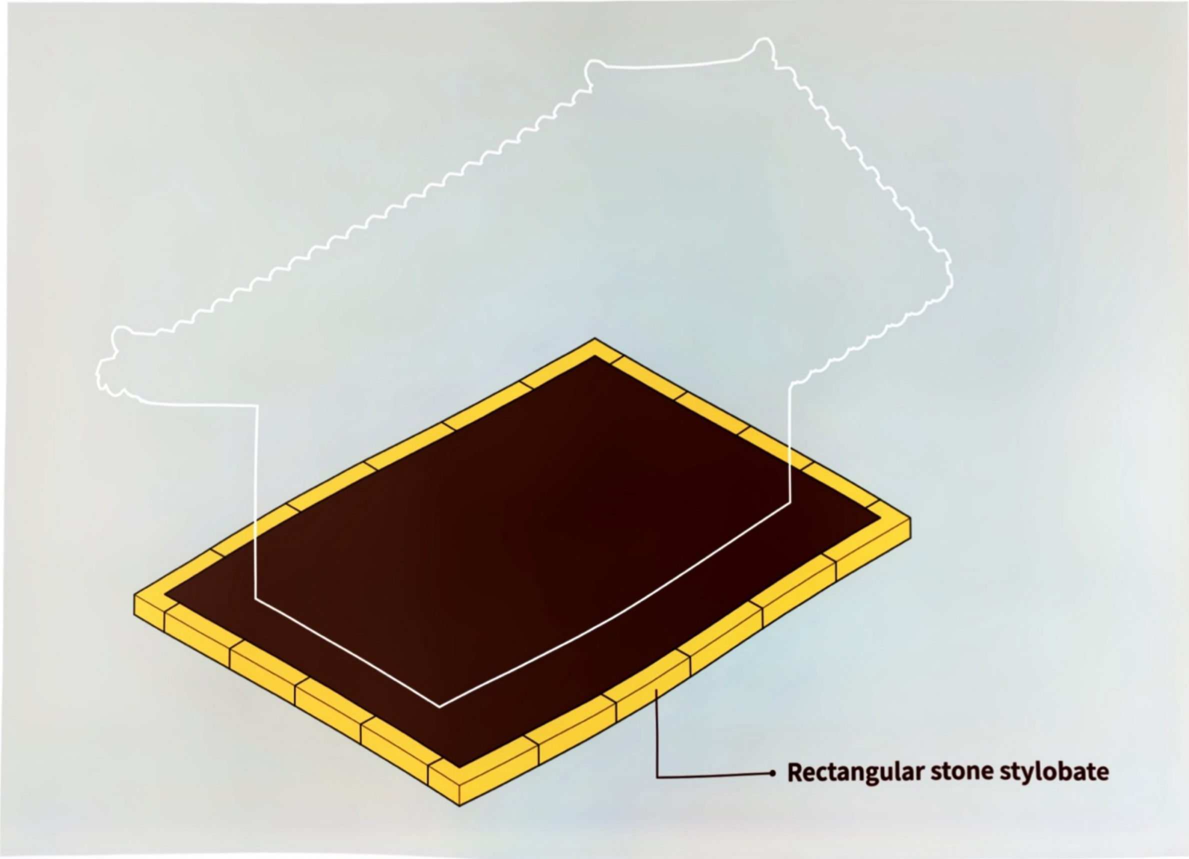
❷ earthen stylobate[tochuk-gidan]
토축기단[土築基壇] / 夯土台基[hāngtǔtáijī] / 土壇[どだん]

❸ brick stylobate[jeonchuk-gidan]
전축기단[塼築基壇] / 砖砌台基[zhuānqìtáijī] / 塼積基壇[せんせききだん]

❹ natural stone stylobate[jayeonseok-gidan]
자연석기단[自然石基壇] / 天然石台基[tiānránshítáijī] / 野面積基壇[のづらづみきだん]

❺ rectangular stone stylobate[jangdaeseok-gidan]
장대석기단[長臺石基壇] / 条石砌台基[tiáoshíqìtáijī] / 切石布積み基壇[きりいしぬのづみきだん]

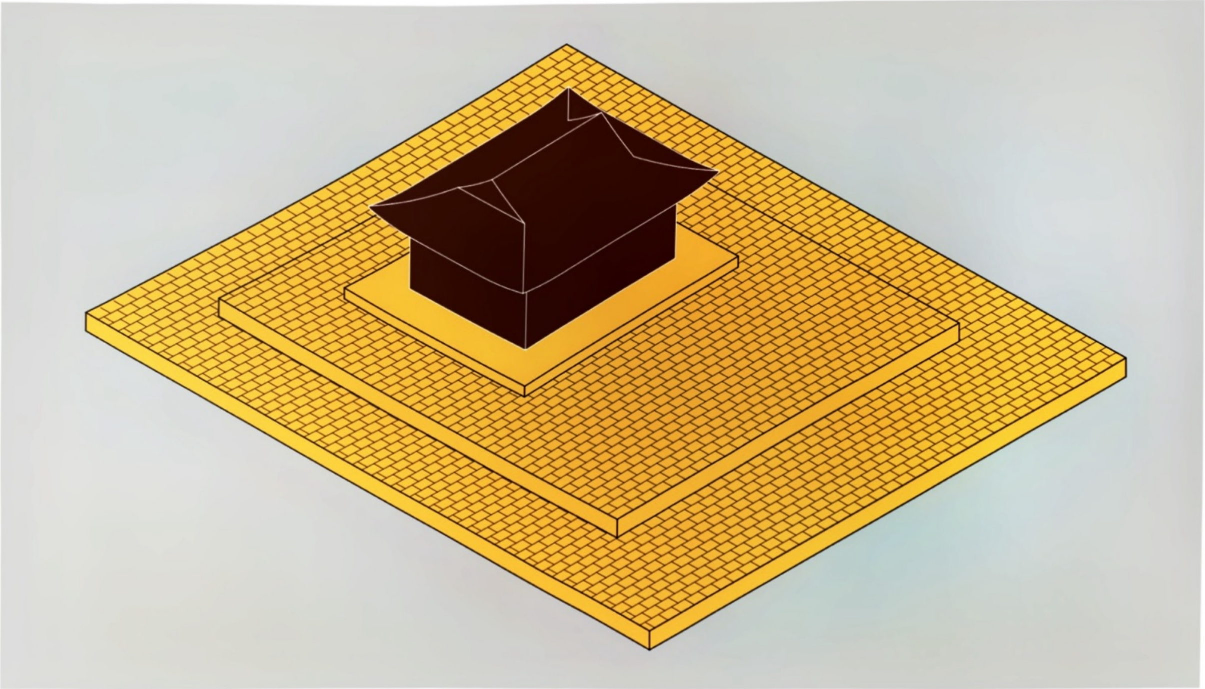
❻ mixed stylobate[honhapsik-gidan]
혼합식기단[混合式基壇] / —— / ——



'Stylobate[gidan]' is a platform that is placed higher than the surrounding ground after building the foundation of the Hanok. It evenly disperses the load of the Hanok and prevents dampness and subsidence of the ground. Being higher than the surrounding ground, it also gives a commanding presence to the building and indicates spatial hierarchy.

1. large stylobate around building[woldae]

Stylobates are categorized into single-step or multi-step stylobates depending on the number of platforms. For instance for the Geunjeongjeon Hall of Gyeongbokgung Palace, a smaller platform is placed on two wider platforms to form the stylobate. The two lower platforms are called woldae. It is placed in front of important buildings such as the main hall[jeongjeon] of palaces and the space used for various events.



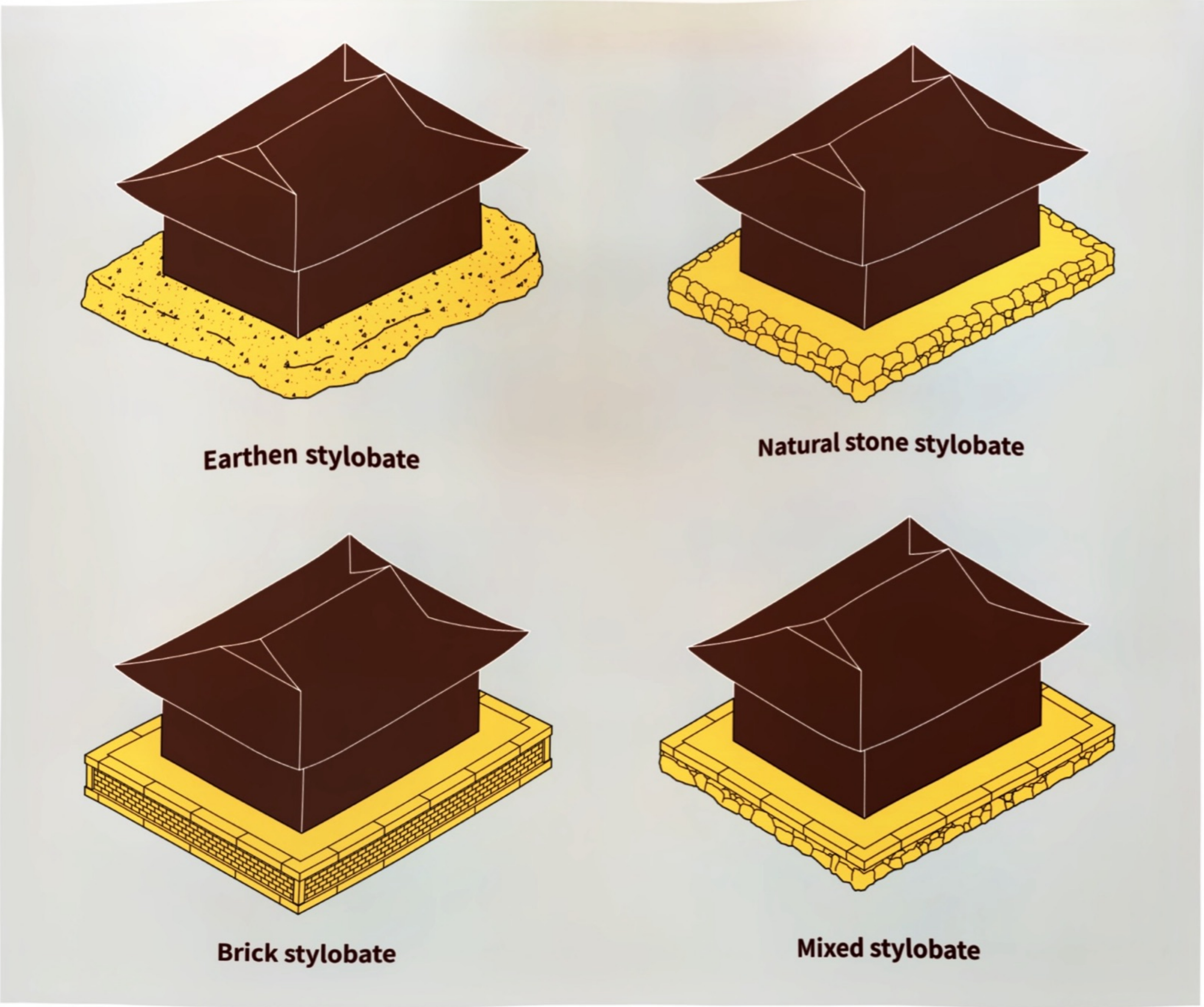
Large stylobate around building

2. earthen stylobate[tochuk-gidan]

The earthen stylobate[tochuk-gidan] is made by packing and building up mud. Gravels or wooden sticks are also mixed in the mud. This kind of stylobate was usually used for the private homes of common people.

3. brick stylobate[jeonchuk-gidan]

The brick stylobate[jeonchuk-gidan] is made by building up bricks. While there are not many Hanoks using this stylobate, the Banghwasuryujeong Pavilion of Hwaseong Fortress remains today.



Types of stylobate

4. natural stone stylobate[jayeonseok-gidan]

The natural stone stylobate[jayeonseok-gidan] is made by stacking fieldstones of the similar size. The fieldstones can be dressed if needed. It is used widely for various Hanoks from private homes to temples.

5. rectangular stone stylobate[jangdaeseok-gidan]

Stones that are processed to a certain length are called jangdaeseok(rectangular stone). The rectangular stone stylobate[jangdaeseok-gidan] made by stacking rectangular stones on their sides. This stylobate is widely used for temples and palaces.

6. mixed stylobate[honhapsik-gidan]

The mixed stylobate[honhapsik-gidan] uses a combination of several materials and methods. The Bulguksa Temple shows this type.

07

column base stone[choseok]

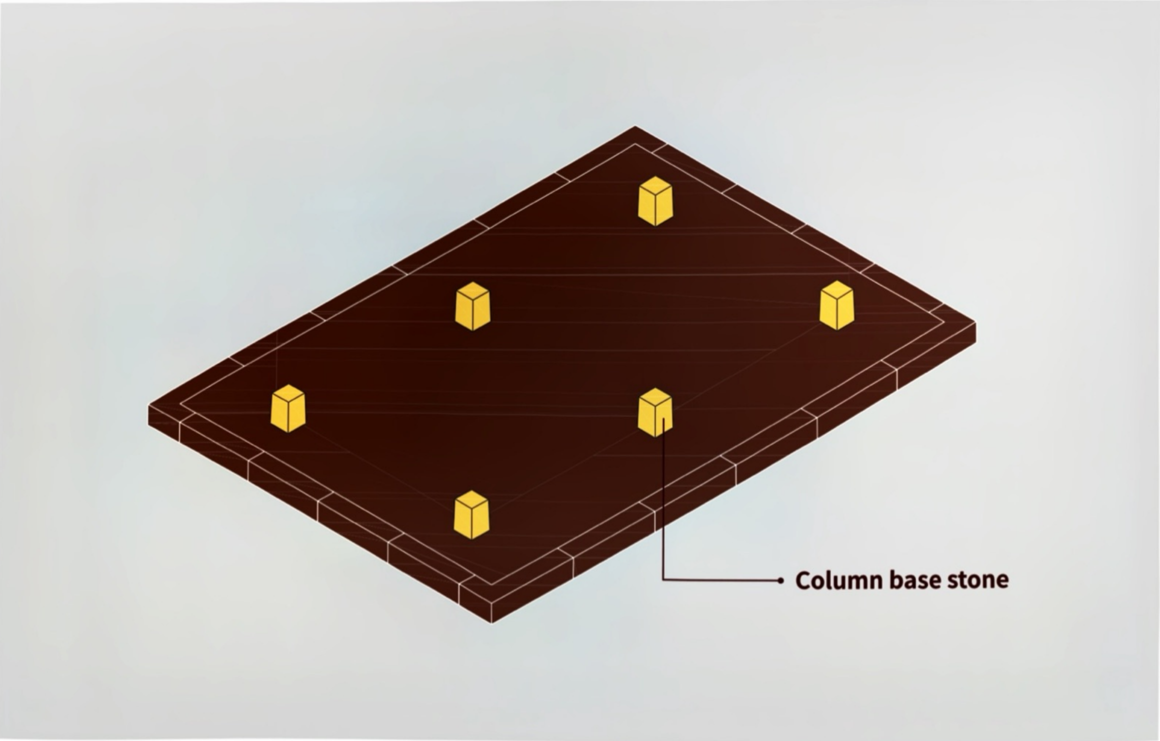
초석[礎石] / 柱础[zhùchǔ] / 礎石[そせき]

❶ natural-shaped column base stone[jayeonseok-choseok]
자연석초석[自然石礎石] / 天然石柱础[tiānránshízhùchǔ] / 自然石礎石[しぜんせきそせき]

❷ round-shaped column base stone[wonhyeong-choseok]
원형초석[圓形礎石] / 圆形柱础[yuánxíngzhùchǔ] / 圓形礎石[えんけいそせき]

❸ square-shaped column base stone[banghyeong-choseok]
방형초석[方形礎石] / 方形柱础[fāngxíngzhùchǔ] / 方形礎石[ほうけいそせき]

❹ tall column base stone[jangju-choseok]
장주초석[長柱礎石] / —— / ——



The 'column base stone[choseok]' refers to the stone that supports the columns and is also called jucho, or juchoseok. It transfers the load of the building to the stylobate or ground. Also, it prevents the bottom of the columns from being damaged because of dampness.

1. natural-shaped column base stone[jayeonseok-choseok]

The natural-shaped column base stone[jayeonseok-choseok] uses fieldstone in their natural state, not processed. It is also called deombeong-jucho because of its round and flat shape.

2. round-shaped column base stone[wonhyeong-choseok]

The round-shaped column base stone[wonhyeong-choseok] refers to column base stone[choseok] that is roundly dressed and is usually used under circular columns. This is mainly used for palaces and temples.

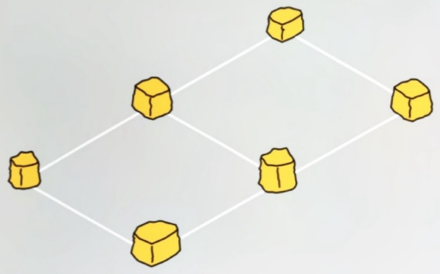
3. square-shaped column base stone[banghyeong-choseok]

The square-shaped column base stone[banghyeong-choseok] refers to column base stone[choseok] that are dressed to a square shape, and is usually used under square shaped columns. However, this type is not used often.

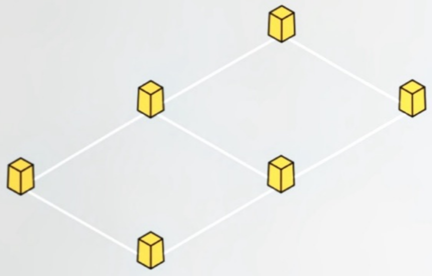
4. tall column base stone

[jangju-choseok]

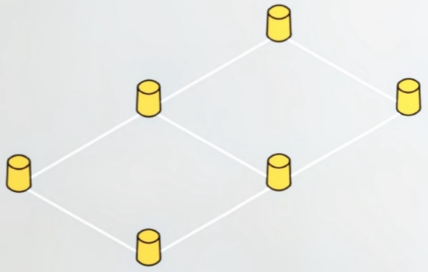
The tall column base stone[jangju-choseok] is dressed to stand higher than usual column base stones[choseok]. It is mostly used for pavilions[nugak] or the bottom part of the raised floors[numaru] in private homes. Its sectional form can be circular, round and many other various shapes.



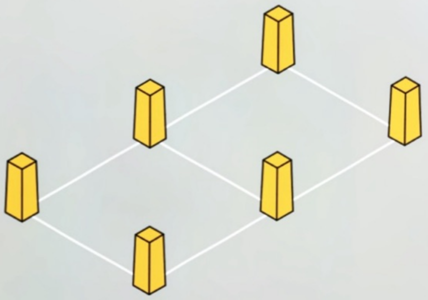
Natural-shaped column base stone



Round-shaped column base stone



Square-shaped column base stone



Tall column base stone

Types of column base stone

08

column[gidung]

기둥[柱] / 柱[zhù] / 柱[はしら]

❶ **tapered column**[minheulrim-gidung]
민흘림기둥 / —— / ——

❷ **entasis column**[baeheulrim-gidung]
배흘림기둥 / 梭柱[suōzhù] / 胴張り柱[どうばりはしら]

❸ **common column**[pyeongju]
평주[平柱] / 檐柱[yánzhù], 外柱[wàizhù] / 柱[はしら]

❹ **tall column**[goju]
고주[高柱] / 金柱[jīnzhù], 内柱[nèizhù] / 建登せ柱[たてのぼせばしら]

❺ **corner column**[wuju]
우주[隅柱] / 角柱[jiǎozhù] / 隅柱[すみばしら]

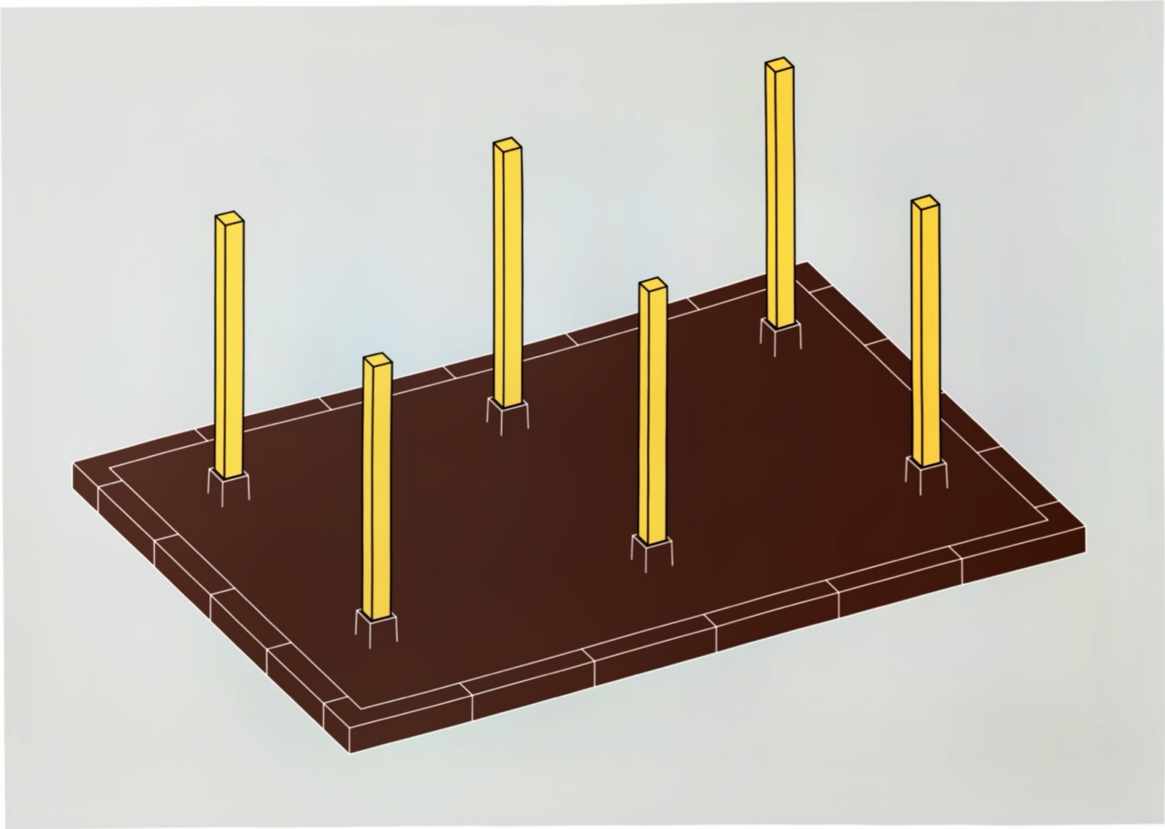
❻ **angle rafters supporting column**[hwalju]
활주[活柱] / 擎檐柱[qíngyánzhù] / 軒支柱[のきじちゅう]

❼ **short column on beam**[dongjaju]
동자주[童子柱] / 蜀柱[shǔzhù], 瓜柱[guāzhù] / 束柱[つかばしら]

With the beams and purlins, the 'column[gidung]' forms the frame structure[gagu] of the Hanok. It is a vertical structural member that transfers the load of the building through the column base stone to the ground. Columns are categorized by their sectional shape which can be circular or square shaped. For aesthetic reasons and a sense of stability, entasis[heulrim] is incorporated, becoming a convex shape or tapering the upper part. Adjusting the layout of columns by moving columns[iju] or subtracting columns[gamju] are practicable as long as the structure allows. With these kinds of column layouts, various forms of spaces can be formed.

1. tapered column[minheulrim-gidung]

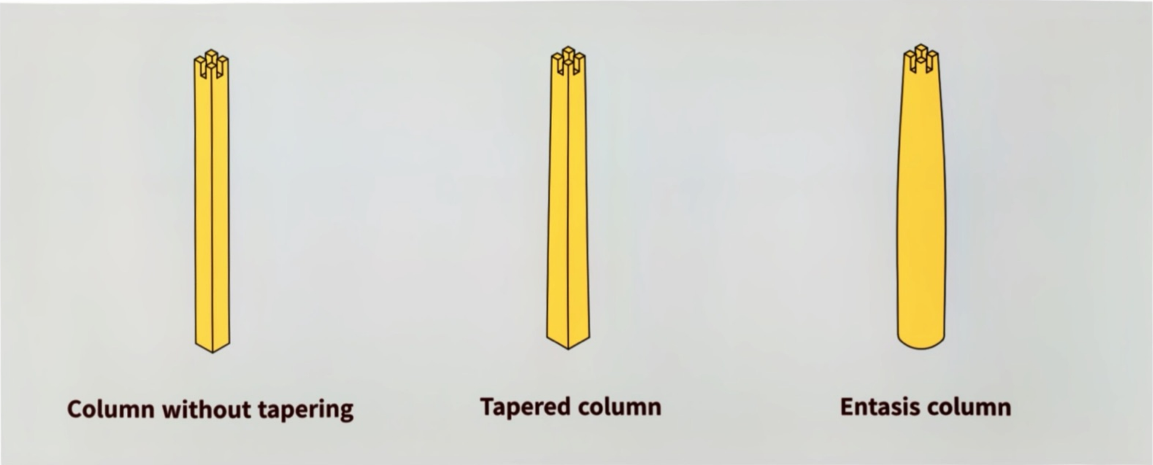
The tapered column[minheulrim-gidung] is a column whose upper part is tapered.



Column

2. entasis column[baeheulrim-gidung]

The entasis column[baeheulrim-gidung] is thickest at 1/3 height from the bottom, becomes thinner towards the bottom and top end, and is thinnest at the top. With this form, this kind of column not only performs structurally well but also adds aesthetic qualities.


Column without tapering
Tapered column
Entasis column

Types of Column

3. common column[pyeongju]

The common column[pyeongju] refers to the general column that is one story in length. It is distinguished from the wuju that is placed in the corners.

4. tall column[goju]

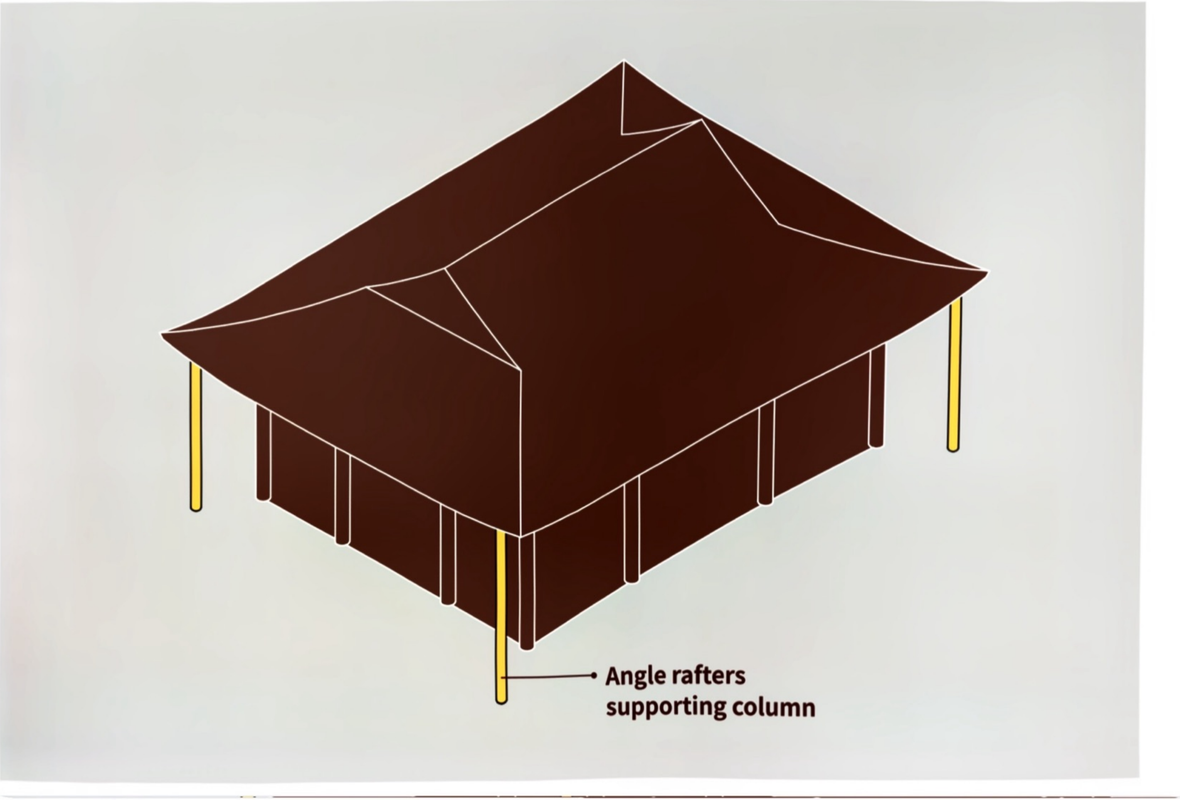
The tall column[goju] is column that is taller than the common column[pyeongju]. It usually supports the middle purlin[jungdori] in 5-ryangga or 7-ryangga structures. When tall columns[goju] are used, a wider interior space can be utilized.

5. corner column[wuju]

The corner column[wuju] refers to columns that are placed on the four corners of the structure.

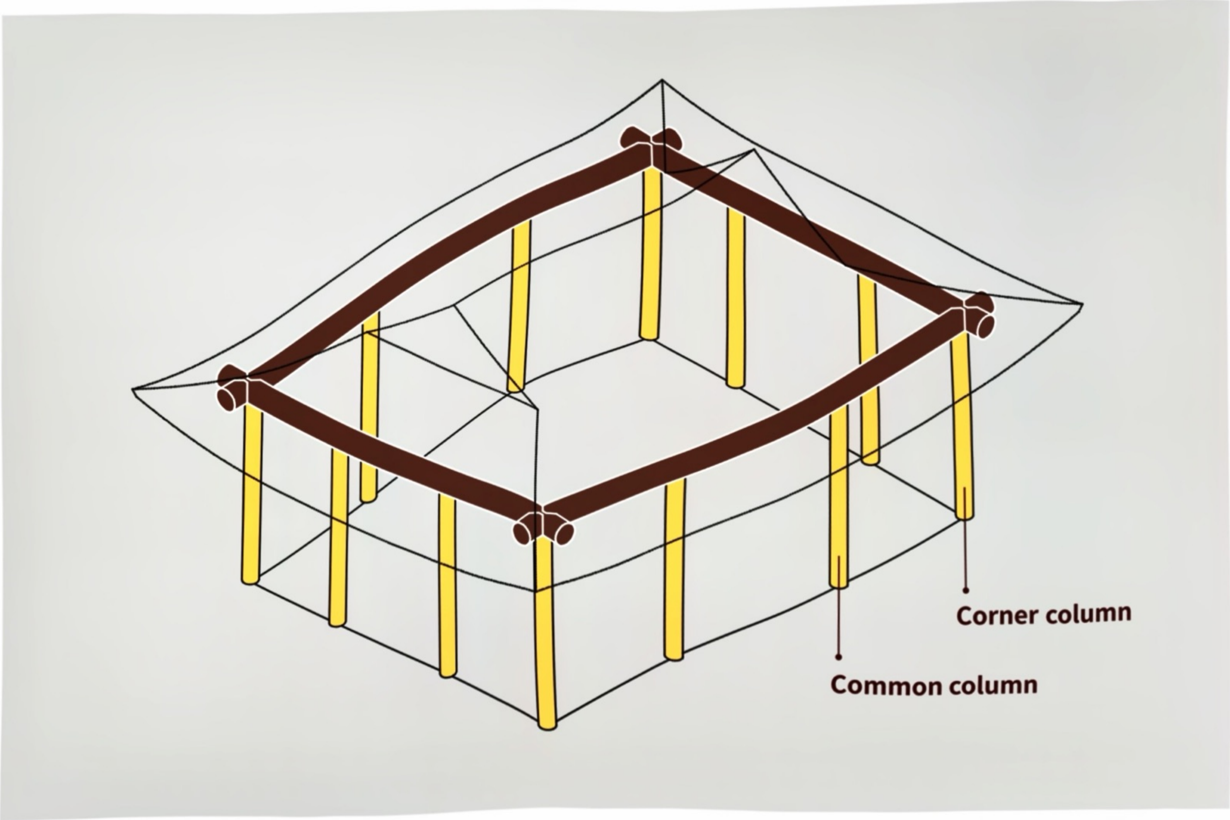
6. angle rafters supporting column[hwalju]

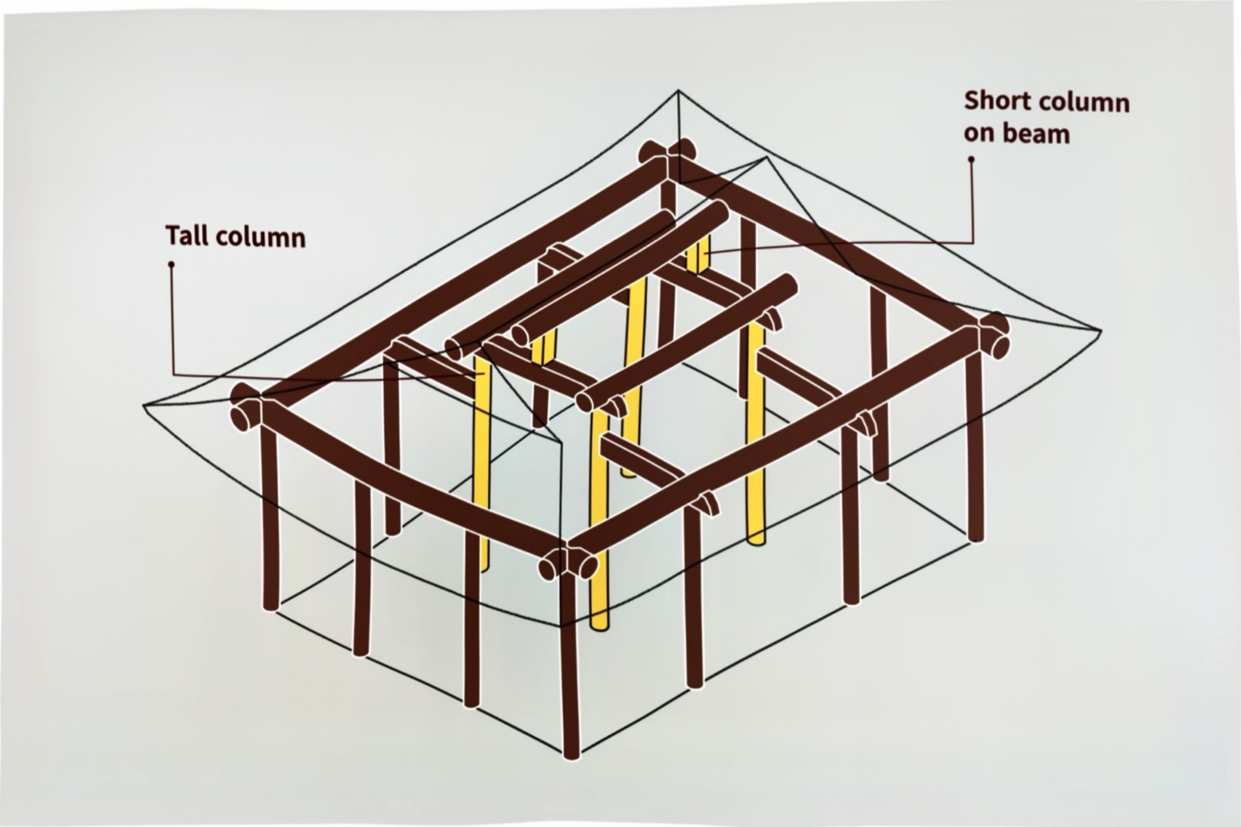
The angle rafters supporting column[hwalju] refers to the thin assisting columns placed on the four corners to support the end of angle rafters[chunyeo] from the outside of the row of common columns. These columns prevent the roof from caving in due to the long depth of the eaves[cheoma].



7. short column on beam [dongjaju]

Because of its function and form, it is named a column but it is rather a member of the roof frame structure[jibungteul]. It is placed on top of the girder[daedeulbo] to support the middle purlin[jungdori].


Corner column
Common column


Short column on beam
Tall column

09

bracket set[gongpo]

공포[栱包] / 斗拱[dǒugǒng] / 斗拱[ときょう], 組物[くみもの]

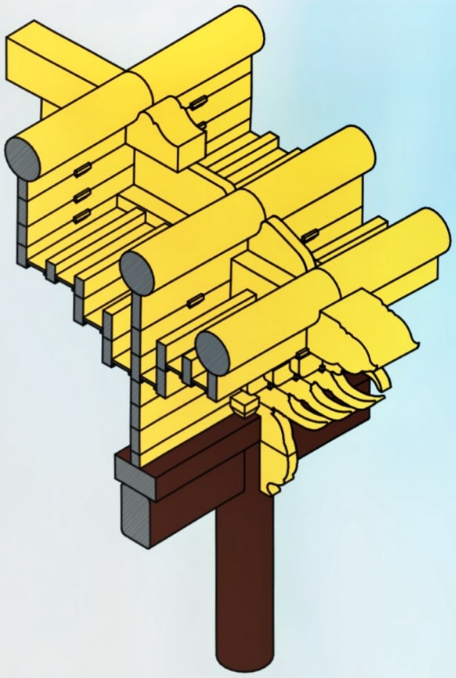
❶ **structure type with multi-bracket set**[daposik]
다포식[多包式] / —— / 詰組[つめぐみ], 禪宗樣[ぜんしゅうよう]

❷ **structure type with simple bracket set**[jusimposik]
주심포식[柱心包式] / —— / 疎組[あまぐみ], 和樣[わよう]

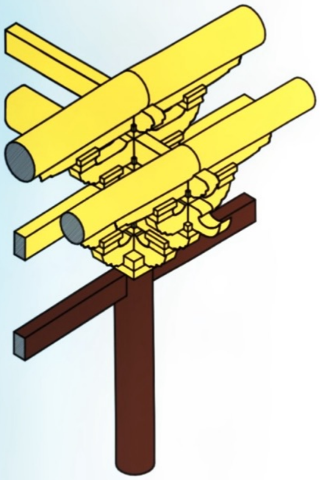
❸ **structure type with bird's wing shaped bracket arm**[ikgongsik]
익공식[翼工式] / —— / ——

❹ **structure type without bracket set**[mindori-sik]
민도리식 / —— / ——

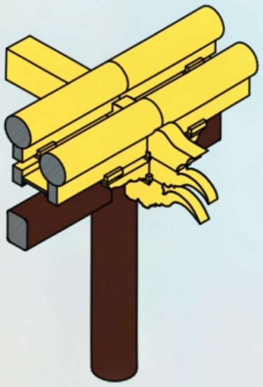
The 'bracket set[gongpo]' refers to a set of members that transfers the load at the end of the eaves to the columns and includes the capitals[judu], small bearing blocks[soro], bracket arms[cheomcha], protruding bracket arms[salmi] etc. It also adds decoration to the upper part of the columns. The capitals[judu] is a dish-shaped member that is placed on top of the column or bracket supporting beam[pyeongbang] to support other members of the bracket set. The small bearing blocks[soro] has a similar shape and connects the bracket arm or protruding bracket arms. The bracket arms[cheomcha] and protruding bracket arms each refer to the horizontal member placed in the purlin and beam direction. The protruding bracket arms is also collectively called salmi. With this, rows of brackets are added to the upper column and the inner and outer part of the bracket arm. Accordingly the size of the bracket set can be labeled with the number of additional rows of bracket arm[chulmok] such as inner 3 chulmoks, outer 2 chulmoks. Hanoks are assorted according to the presence of a bracket set and its level of sophistication. The bracket set is an important clue in identifying the era to which the structure belongs since the forms differ significantly across time.



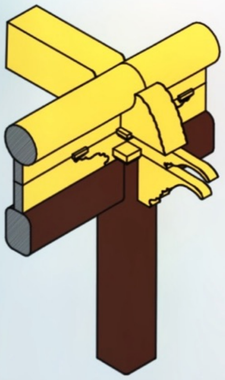
Structure type with multi-bracket set



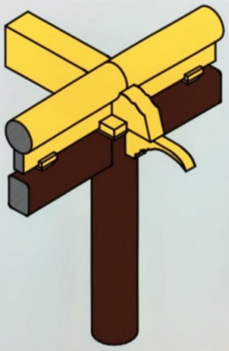
Structure type with simple bracket set



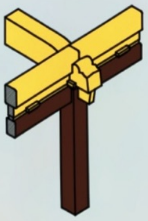
Structure type with bird's wing shaped bracket arm
(1 chulmok 2 ikgong)



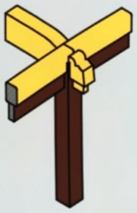
Structure type with bird's wing shaped bracket arm
(2 ikgong)



Structure type with bird's wing shaped bracket arm
(Cho ikgong)



Structure type without bracket set
(Sorosujang)



Structure type without bracket set
(Mindori)

Types of bracket set

1. structure type with multi-bracket set[daposik]

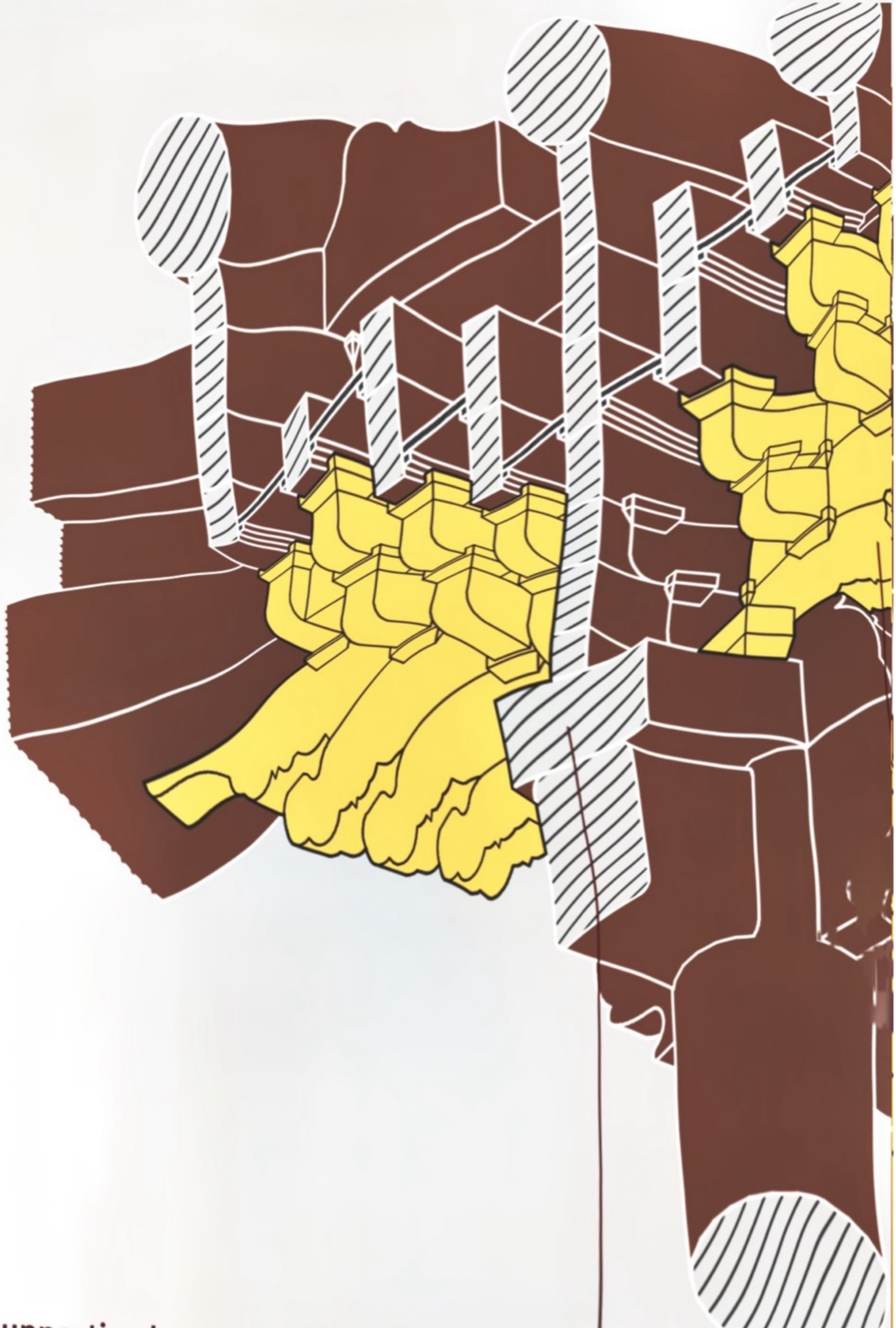
Structure type with multi-bracket set[daposik] refers to the structure of the house with bracket sets that include the bracket set on column row[jusimpo] laid on top of the column, and the bracket set between columns[juganpo], laid on top of the bracket set supporting beam[pyeong-bang] in between columns. It is more ornamental compared to the structure type with simple bracket set[jusimposik], thus mainly being used for temples and palaces.

2. structure type with simple bracket set[jusimposik]

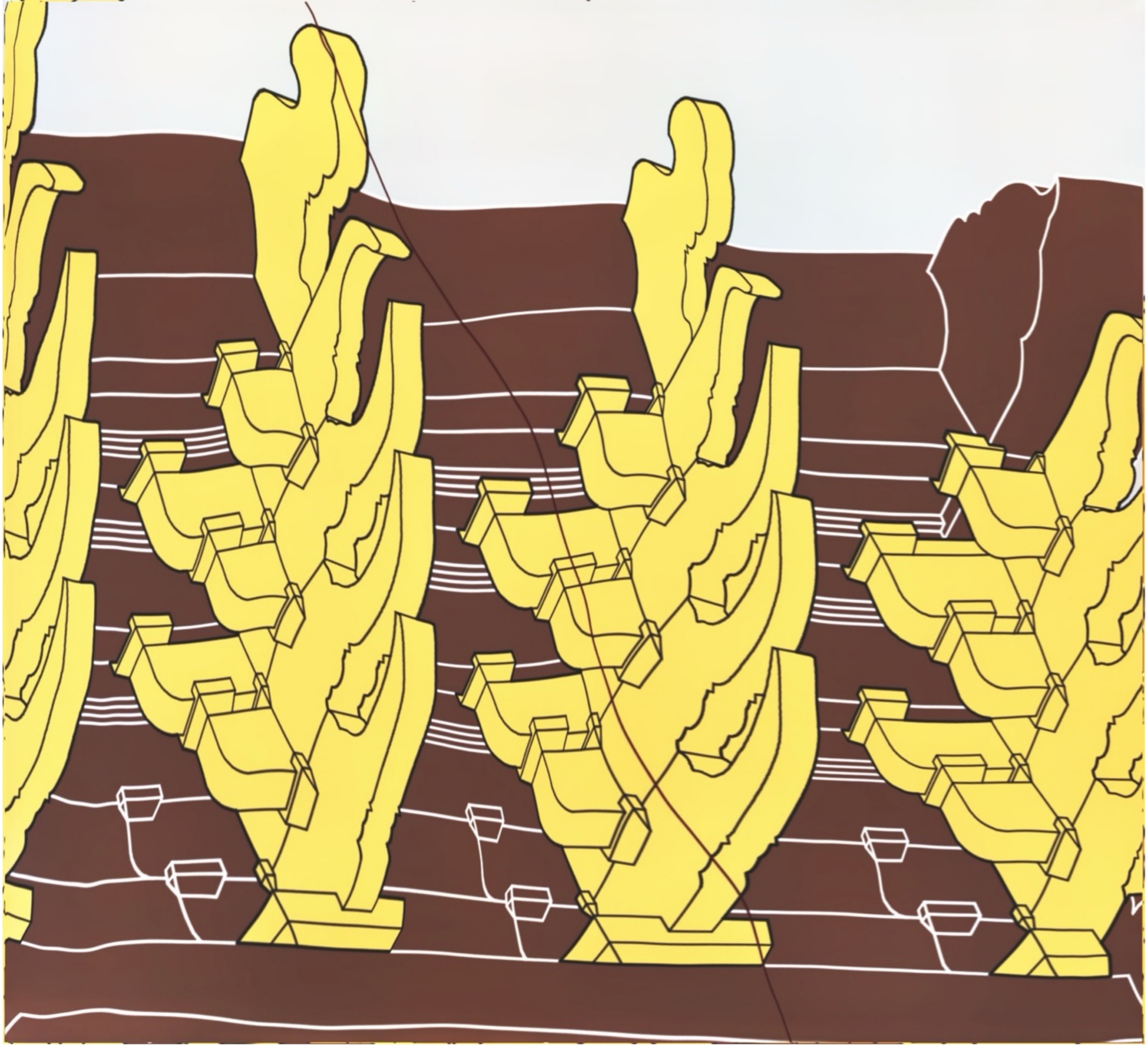
House with bracket sets[pojib] that only has the bracket set on column row[jusimpo] is classified as structure type with simple bracket set[jusimposik]. The bracket is only placed on top of the column, so the bracket set supporting beam which is used in the structure type with multi-bracket set[daposik], is not present. It is used for houses with a gabled roof[matbae-jibung] and mainly for small scale structures or spaces that emphasize a solemn atmosphere.

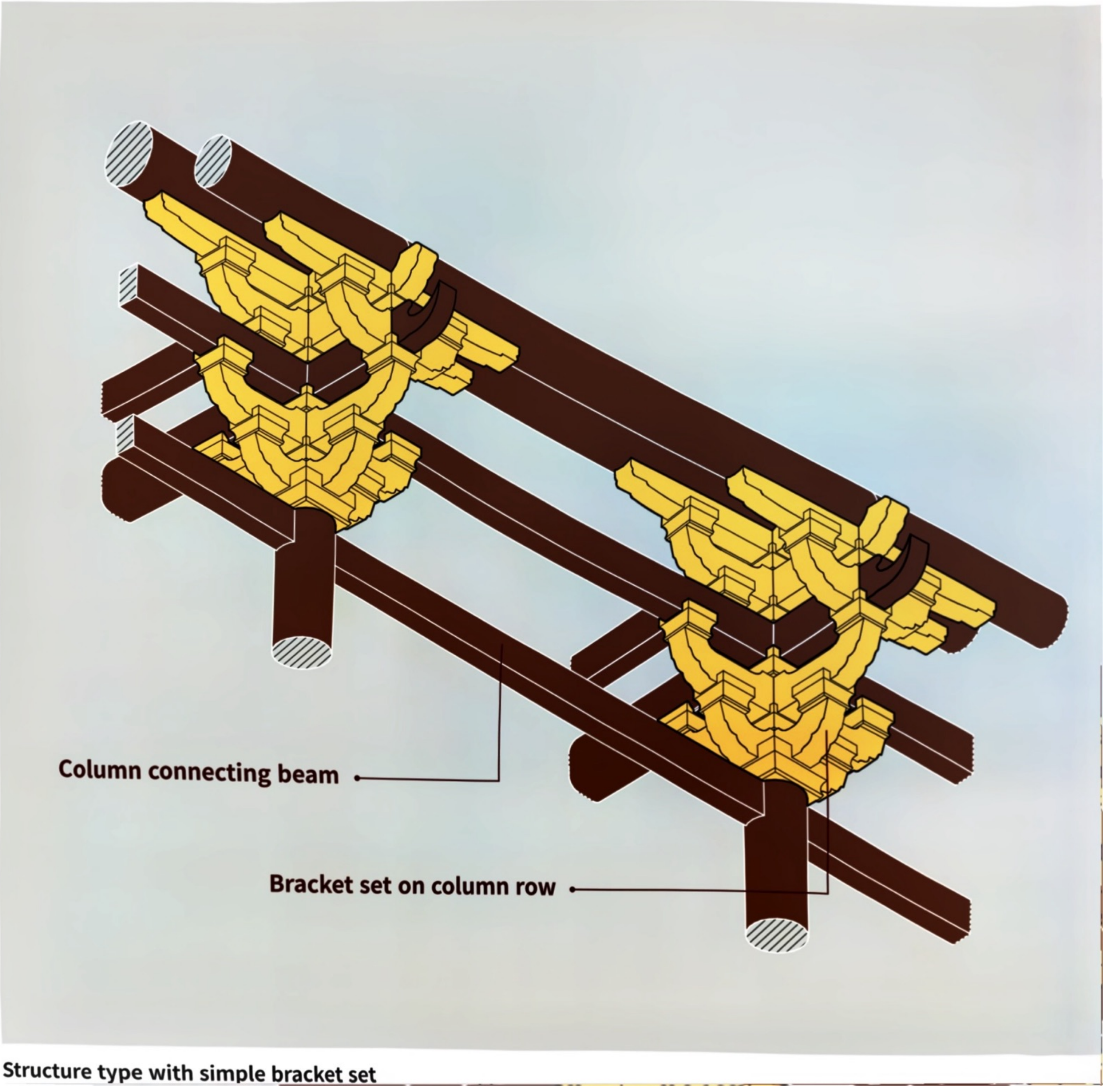
3. structure type with bird's wing shaped bracket arm[ikgongsik]

Ikgong refers to the protruding bracket arm's[jegong] pointy shape that resembles a bird's wing. It can be used for the house with bracket set and the structure that is only composed of this type of brackets is called the ikgong-sik. It does not have any additional rows of bracket arm and is labeled by the number of bracket arms protruding towards the front, such as one-ikgong type[cho-ikgong], two-ikgong type[i-ikgong] etc. Although not the shape of a bird's wing, round-shaped ikgong type[mul-ikgong] has rounded ends and is categorized as an ikgong.

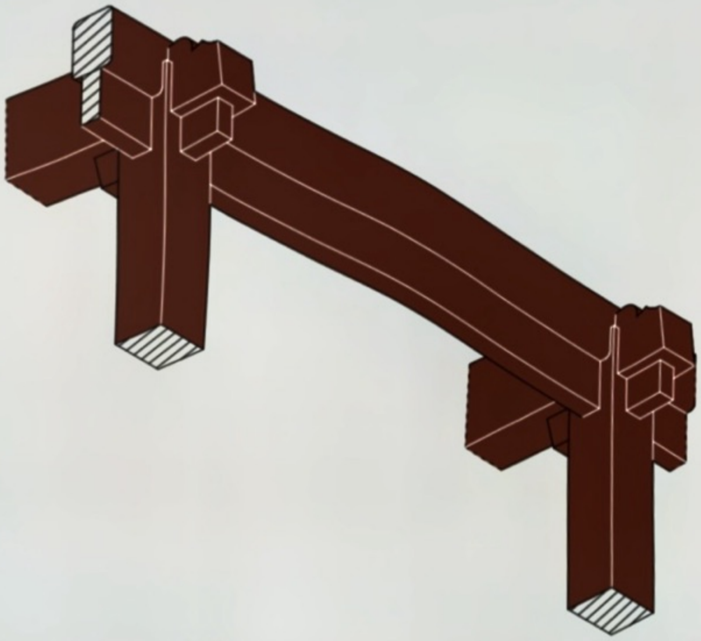


racket set supporting beam

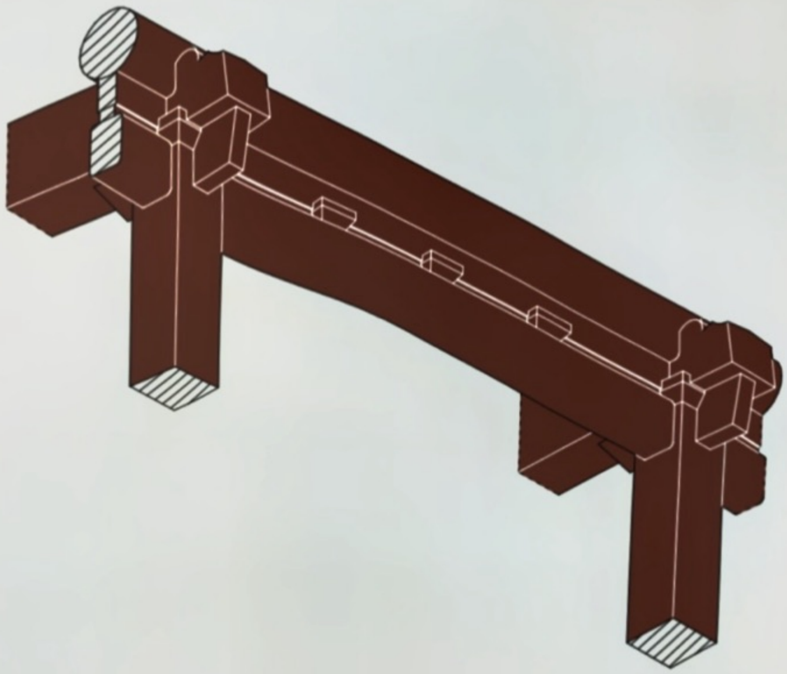



Column connecting beam
Bracket set on column row

Structure type with simple bracket set



Mindori



Sorosujang

(Decorated with small bearing blocks)

10

frame structure[gagu]

가구[架構] / 梁架[liángjià] / 架構[かこう], 骨組構造[ほねぐみこうぞう]

❶ **beam supports**[boaji]
보아지[楆奉, 甫兒只] / 丁斗栱[dīngdòugǒng], 插栱[chāgǒng] / 木鼻[きばな]

❷ **column connecting beam**[changbang]
창방[昌枋]] / 阑额[láné], 额枋[éfāng] / 頭貫[かしらぬき]

❸ **bracket set supporting beam**[pyeongbang]
평방[平枋] / 普拍枋[pǔpāifāng], 平板枋[píngbǎnfāng] / 台輪[だいわ]

❹ **beam**[bo]
보[梁] / 梁[liáng] / 梁[はり]

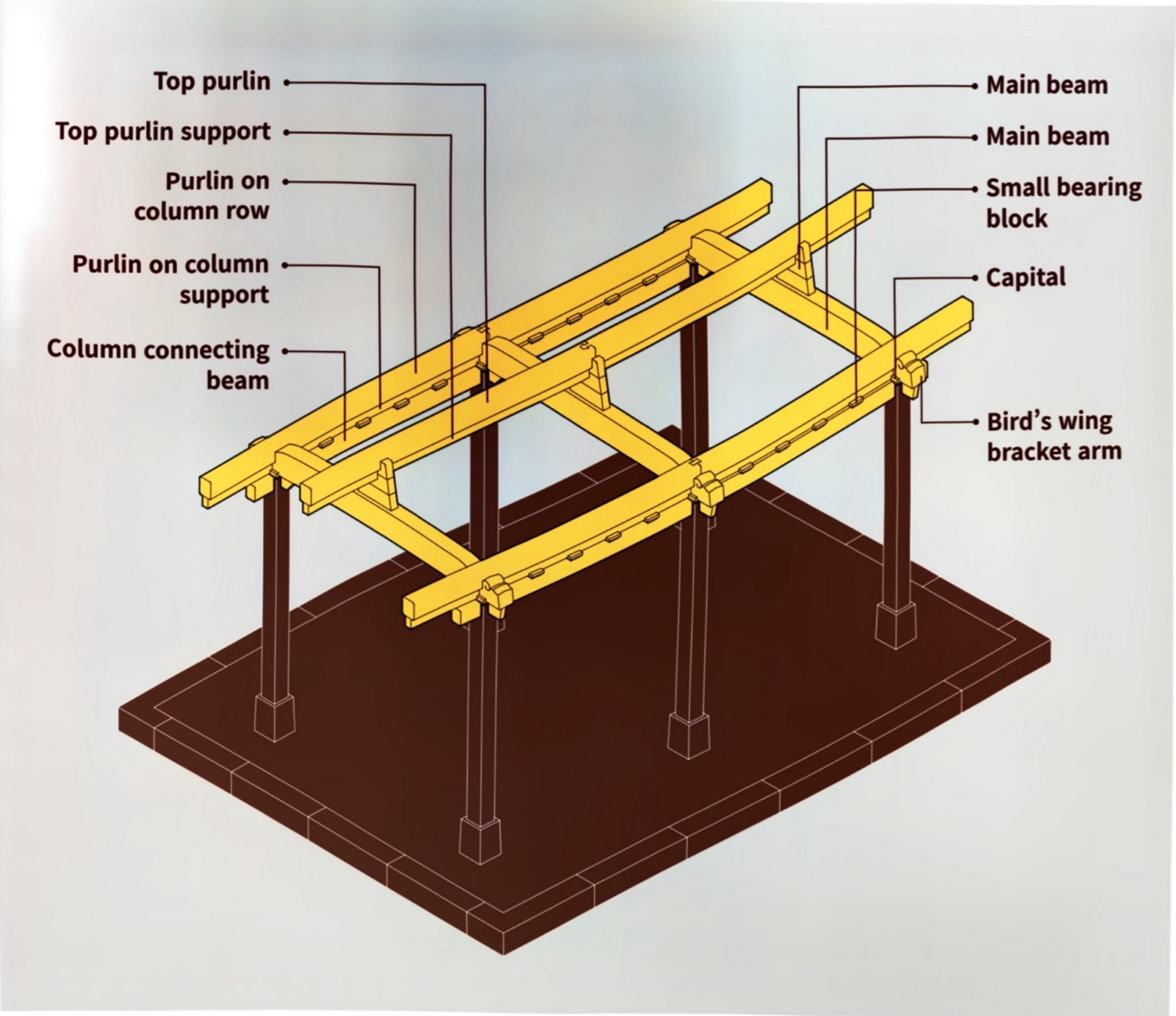
❺ **truss post**[daegong]
대공[臺工] / 駝峯[tuófēng], 脊瓜柱[jǐguāzhù] / 束[つか]

❻ **purlin supports**[jangyeo]
장여[長舌] / 替木[tìmù] / 肘木[ひじき]

❼ **purlin**[dori]
도리[桁] / 槫[tuàn], 桁[héng], 檩[lǐn] / 桁[けた]

'Frame structure[gagu]' is the fundamental frame of the Hanok and is composed of the basic members: columns, beams, and purlins. The plan and section of each frame structure differs according to the space usage. In other words, the quantity, position, and length of each column, beam, and purlin depend on the spatial layout and the program. Also frame structures[gagu] are subdivided into several types accordingly.

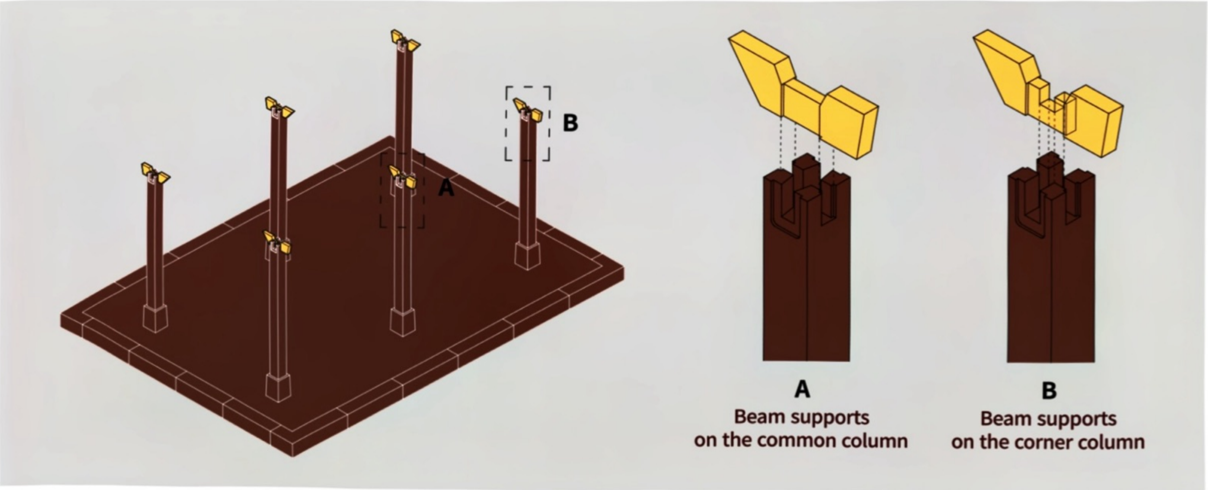
The 'upper frame structure[sangbu-gagu]' refers to the structural frame that transfers the load of the roof and roof frame to columns.


Top purlin
Top purlin support
Purlin on column row
Purlin on column support
Column connecting beam
Main beam
Main beam
Small bearing block
Capital
Bird's wing bracket arm

Frame structure

1. beam supports[boaji]

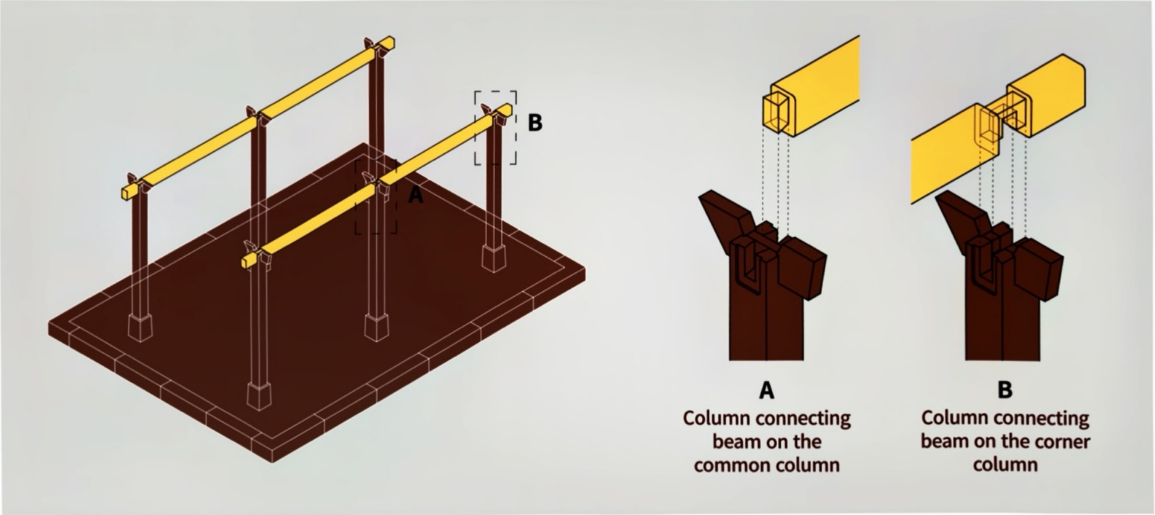
The beam supports[boaji] is located where the beams and columns meet and supports the beams. It is also called yangbong. When used for temples and palaces, the two ends are carved to have a decorative effect.


B
A
A
Beam supports on the common column
B
Beam supports on the corner column

Beam supports

2. column connecting beam[changbang]

The column connecting beam[changbang] is a longitudinal member located on the top of the columns to connect the columns on the left and right. With the structure type without bracket set, the purlin is connected directly to the columns without a column connecting beam, while with the structure type with multi-bracket set, a bracket set supporting beam[pyeongbang] is placed on top of the column connecting beam. Because column connecting beams are joined at a right angle on top of the corner column, in order to reinforce, a certain length of the column connecting beam is carved and led out beyond the column row.


B
A
A
Column connecting beam on the common column
B
Column connecting beam on the corner column

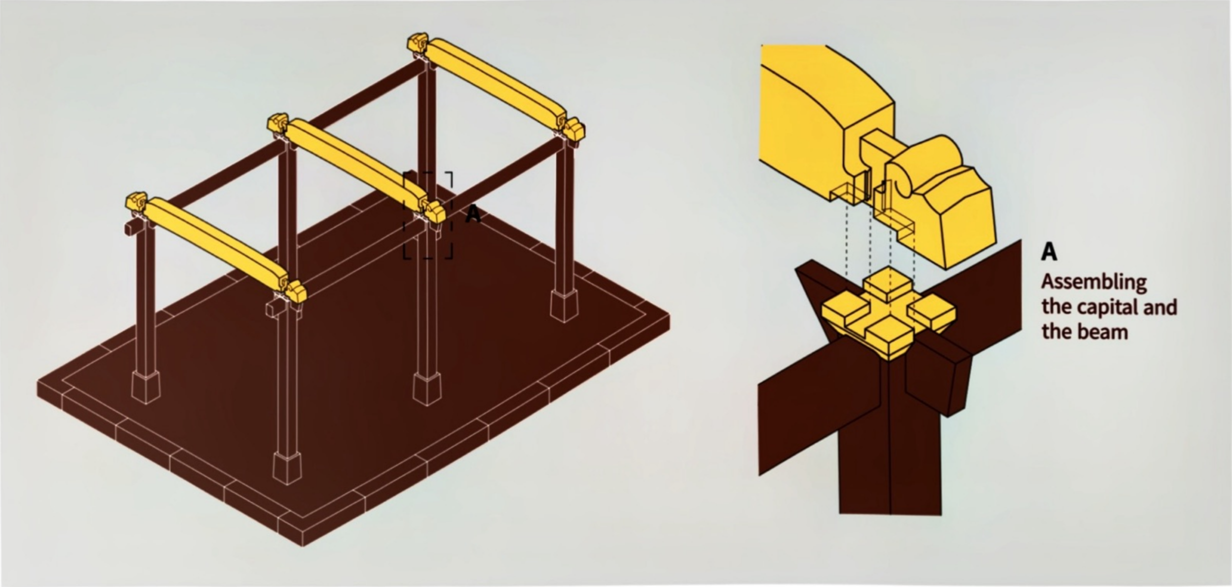
Column connecting beam

3. bracket set supporting beam[pyeongbang]

With the structure type with multi-bracket set, a bracket set supporting beam[pyeongbang] is placed on top of the column connecting beam to bear the weight of the bracket set between columns [juganpo], and the bracket set supporting beam is wider than the column connecting beam. Alike the column connecting beam, at the corner column a certain length of the bracket set supporting beam is led out beyond the column row, but unlike the column connecting beam, it is not carved. Generally for the structure type with simple bracket set, that with bird's wing shaped bracket arms, and that without bracket set, only the column connecting beam, and for the structure type with multi-bracket set, both the column connecting beam and bracket set supporting beam are used. (→ 9-1 Structure type with multi-bracket set[daposik])

4. beam[bo]

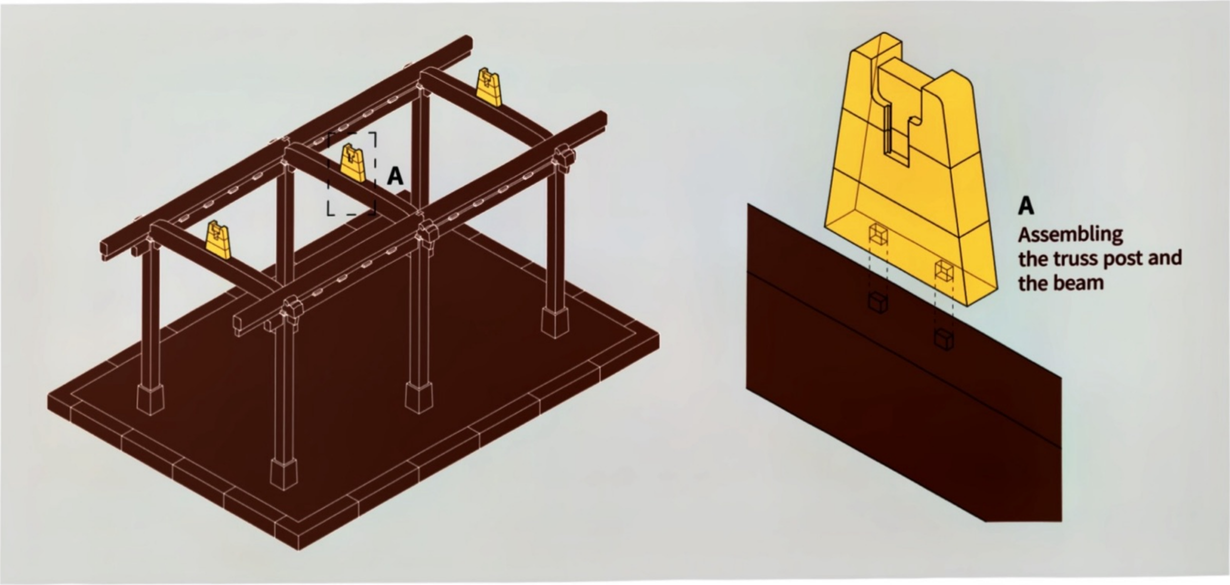
The beam[bo] is a horizontal member that transfers all of the load from the upper frame to the columns. Unlike the column connecting beam, it connects the columns on the front and back of the structure. Because it is the member that takes on the biggest load, the cross sectional area is also the largest. Depending on the structural frame type, the beam is placed not only on the head of the columns but on various layers, and it has various names according to its location. For instance for the 7-ryangga, the main beam[daedeulbo] connects the columns and on top of that, the middle beam[jungbo] and top beam[jongbo] are placed.


A
A
Assembling the capital and the beam

Beam

5. truss post[daegong]

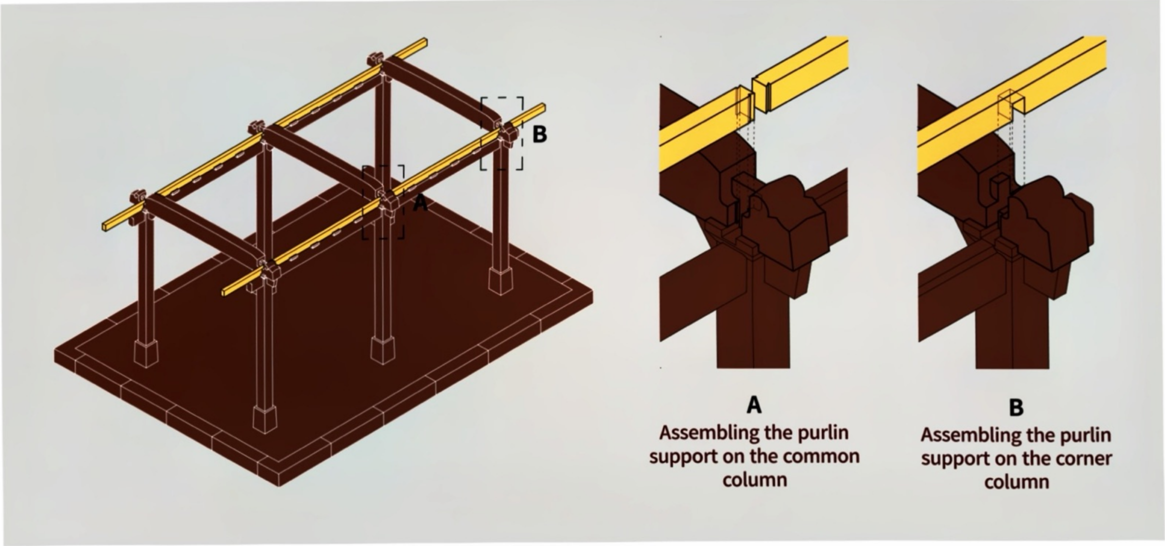
The truss post[daegong] is a vertical member that is placed in between beams to support the upper beam or purlin. There are various shapes such as the upside-down ‘y’-shaped truss post, flat board truss post[pan-daegong], flower-shaped truss post[hwaban-daegong], etc.


A
A
Assembling the truss post and the beam

Truss Post

6. purlin supports[jangyeo]

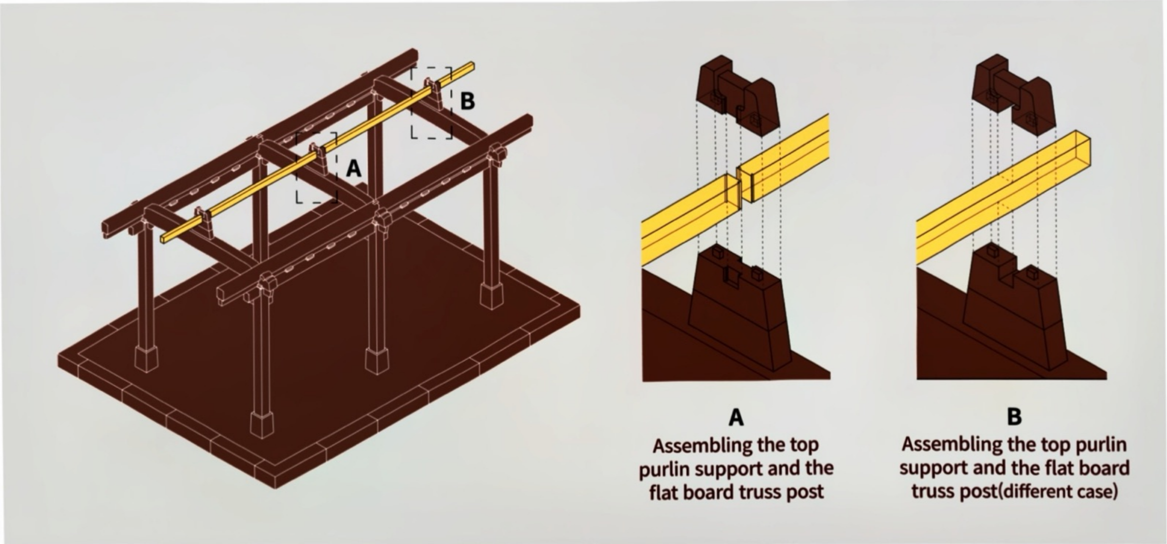
The purlin supports[jangyeo] is a member that is placed under the purlins and supports the purlins. Usually its width equals that of wall frame components[sujangjae] such as the bracket arms[cheomcha] or lintels, so its width is particularly called the sujangpok(width of wall frame components). This width is a reference when labeling the lengths of other members.



A
Assembling the purlin support on the common column

B
Assembling the purlin support on the corner column

Purlin supports



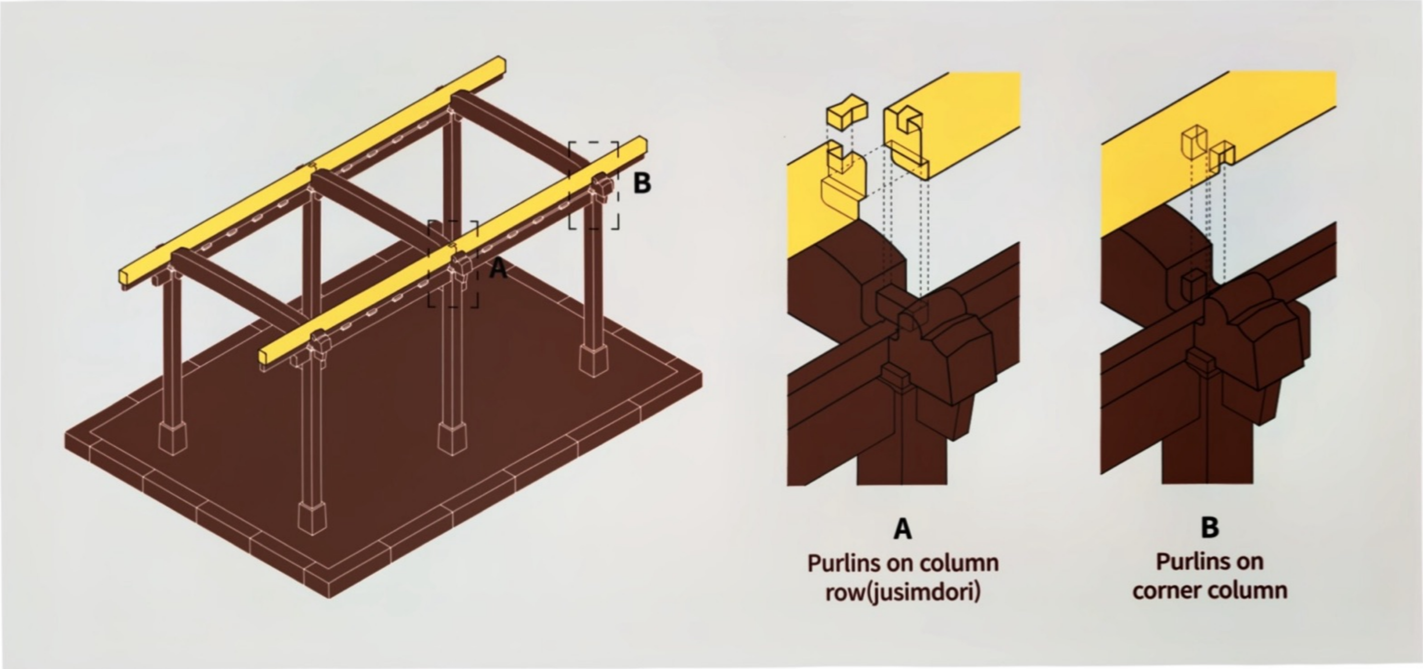
A
Assembling the top purlin support and the flat board truss post

B
Assembling the top purlin support and the flat board truss post(different case)

Top purlin support

7. purlin[dori]

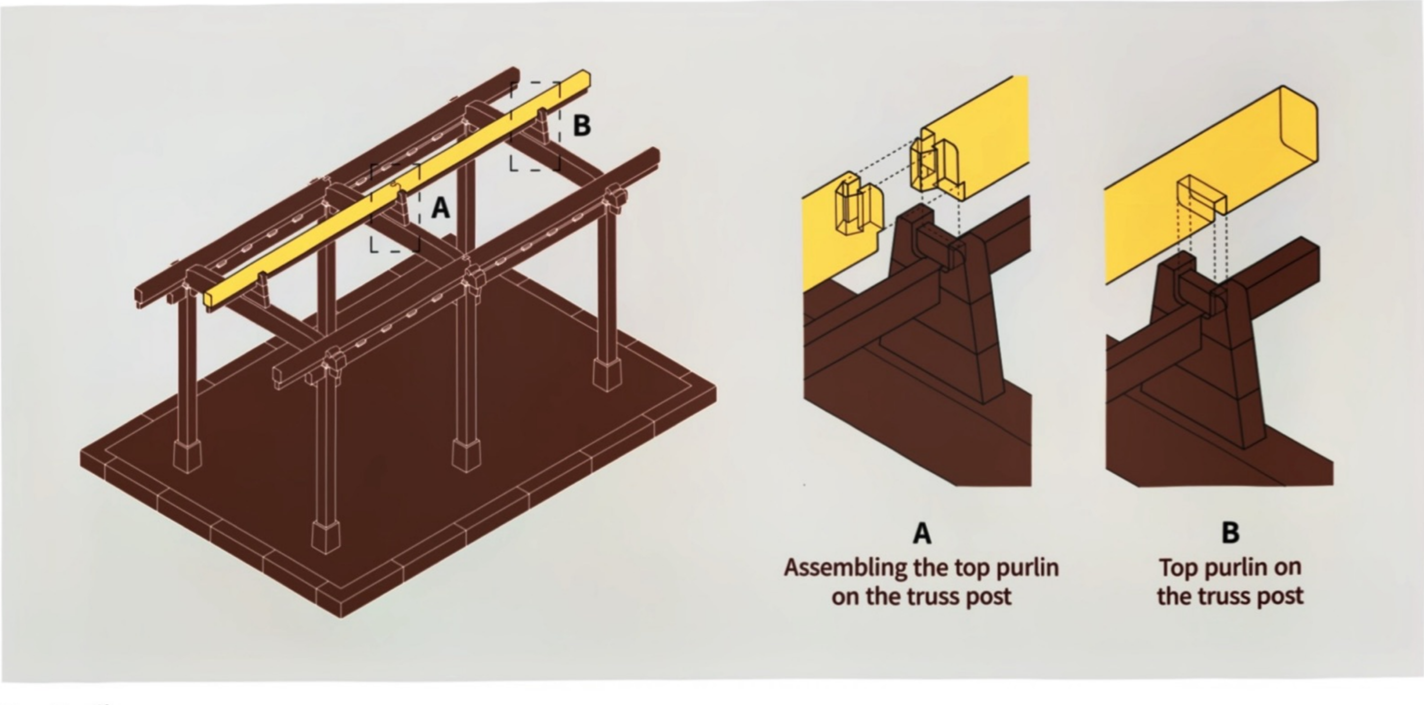
The purlin[dori] is a member that is placed along the building on the very top of the upper frame structure and directly supports the roof frame, including the rafters. Depending on the cross-sectional shape, the square shaped purlin is called square-shaped dori[napdori], and the circular purlin is called round-shaped dori[guldori]. Generally the round-shaped purlins are used for important buildings of a private home, temples or palaces. Moreover, there are various types depending on its placement; the purlins on column row[jusimdori] are placed on the common columns' row, and the top purlin[jongdori] is placed on the ridge[yongmaru] row. For a Hanok over 5-ryangga a purlin is also placed on top of the short column on the beams[dongjaju] and is called the middle purlin[jungdori]. For houses with brackets, a special purlin called purlin on additional row of bracket arm[chulmokdori] is placed on the additional row of bracket arms. This type of purlins are categorized into two, purlin on inner row of bracket arm[nae(chul)mokdori], which is on the inner side of the column row, and the purlin on outer row of bracket arm[oe(chul)mokdori] which is on the outer side.



A
Purlins on column row(jusimdori)

B
Purlins on corner column

Purlin



A
Assembling the top purlin on the truss post

B
Top purlin on the truss post

Top Purlin

11

roof[jibung]

지붕 / 屋顶[wūdǐng] / 屋根[やね]

❶ **eaves**[cheoma]
처마 / 屋檐[wūyán] / 軒[のき]

❷ **rafters**[seokkarae]
서까래[椽木] / 椽[chuán] / 垂木[たるき]

❸ **angle rafters**[chunyeo]
추녀[春舌] / 大角梁[dàjiǎoliáng], 老角梁[lǎojiǎoliáng] / 隅木[すみぎ]

❹ **laths on rafters**[pyeonggodae]
평고대[平交臺, 平高臺] / 小连檐[xiǎoliányán] / 木負[きおい]

❺ **shingle**[gaepan]
개판[蓋板] / 望板[wàngbǎn] / 野地板[のじいた]

❻ **barge board**[bakgong]
박공[牔栱] / 博风板[bófēngbǎn], 博缝板[bóféngbǎn] / 破風[はふ]

❼ **roof filling wood**[jeoksim]
적심[積心] / —— / 下葺き材[したぶきざい]

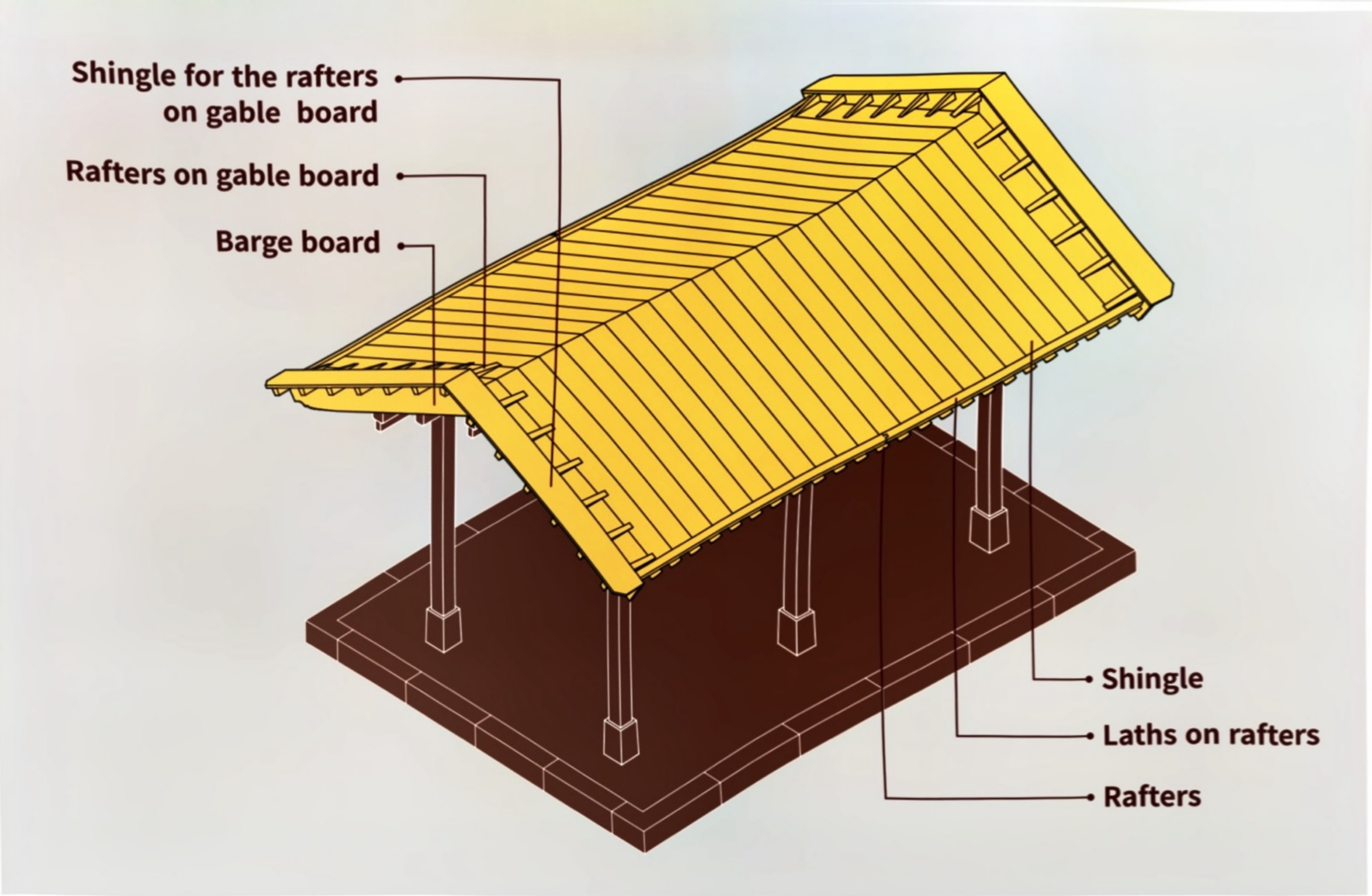
❽ **roof filling soil**[boto]
보토[補土] / 苫背[shànbèi] / 葺土[ふきつち]

❾ **pan tile supporting laths**[yeonham]
연함[椽檻] / 瓦口[wǎkǒu] / 瓦座[かわらざ]

❿ **roof tile**[giwa]
기와[瓦] / 瓦[wǎ] / 瓦[がわら]

⓫ **ridge of a roof**[yongmaru]
용마루 / 正脊[zhèngjǐ] / 大棟[おおむね]

The 'roof[jibung]' accounts for a large part of the Hanok, and its form is an important element that determines the Hanok's beauty. For Hanok, flat roofs cannot be found because Korean houses have to endure rainy, snowy, and windy climates through the four seasons. Many of the Hanok roofs often show curvilinear shapes to minimize the imposing appearance of massive volume. There are different types of roofs according to the materials and shape.

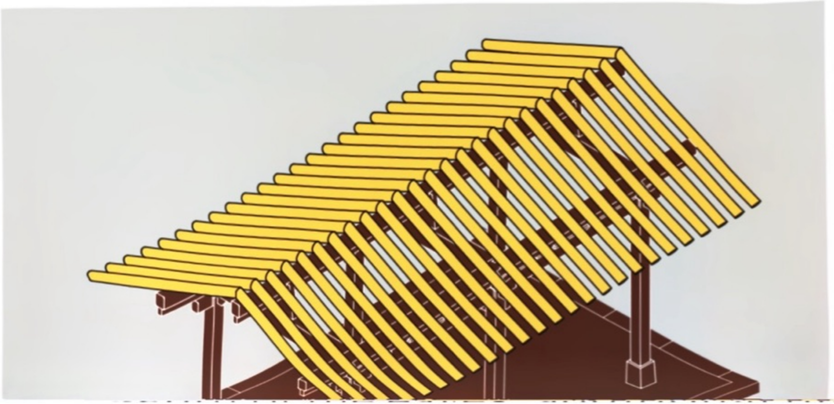

Shingle for the rafters on gable board
Rafters on gable board
Barge board
Shingle
Laths on rafters
Rafters

Underpart of the roof

1. eaves[cheoma]

The eaves[cheoma] refers to the underpart of the roof where the rafters protrude out of the row of common columns. It is a spatial buffer that keeps the rain out from the side and creates shade. In order to create the certain depth of the eaves, additional rafters[buyeon] can be added to form a double layered eaves[gyeopcheoma].

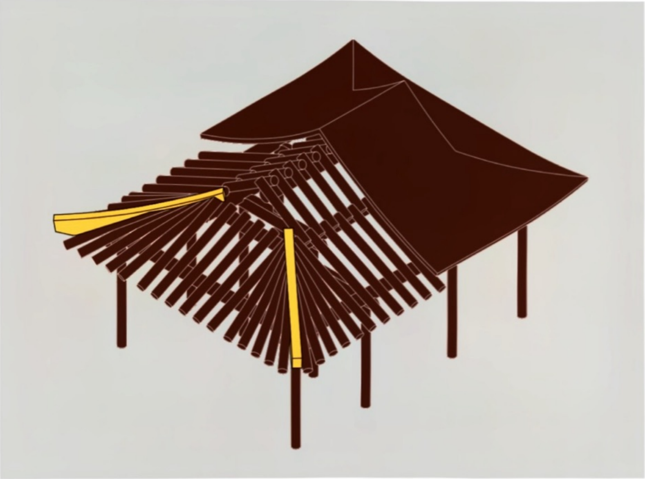
2. rafters[seokkarae]



The rafters[seokkarae] is a diagonal member placed on top of the purlins. It forms the slanted roof surface of the front, back or side of the building. For a house with 3 purlins, one type of rafters is laid to connect the top purlin and the

the long rafters[jangyeon] that connect the middle purlin and purlin on additional row of bracket arm. For a gabled roof rafters are laid only on the front and back of the Hanok, while for a gambrel roof, short rafters are laid on the front and back, and long rafters are laid on all directions. In order to let out the eaves longer, a short rafter can be placed on top of the long rafter which is called the buyeon(additional rafter). Such eaves are distinguished from the single eaves called hotcheoma that does not have an additional rafter and is called the double layered eaves[gyeopcheoma].

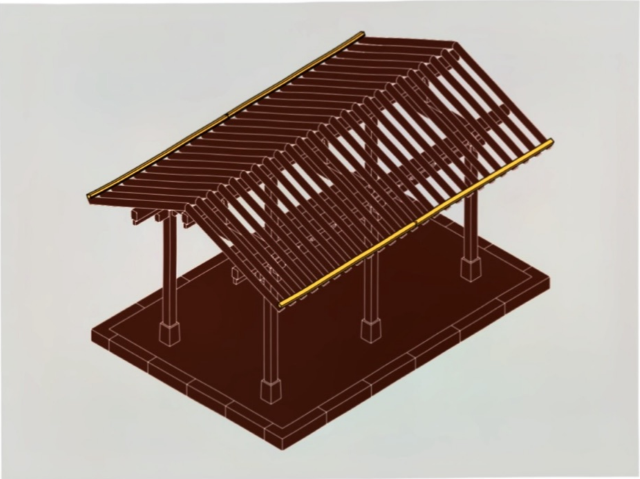
3. angle rafters[chunyeo]



Angle rafters

The angle rafters[chunyeo] is a member placed at a 45° angle on the roof edge of a gambrel roof or hipped roof. This angle rafter is placed diagonally from the top of the corner column to the purlin on additional row of bracket arm. On the end of the angle rafter, the lath on rafters is laid to form the roof curve. Place the rafters along the curve of laths on rafters. In the case of a double layered eaves, on top of the angle rafter, place short angle rafters called sarae at the same height as the additional rafters to support the roof's weight.

4. laths on rafters[pyeonggodae]

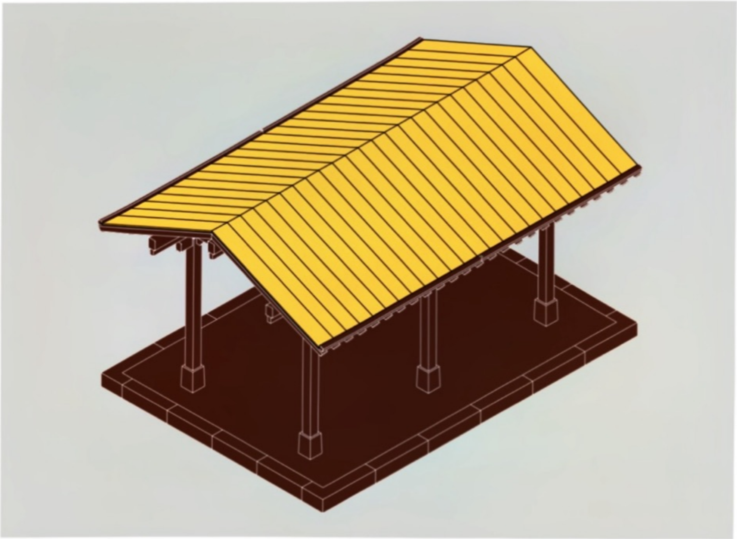


Laths on rafters

The laths on rafters[pyeonggodae] is a long horizontal member hung on the angle rafters of both ends and is used as reference when forming the roof curve. Because the rafters are placed along the curve of this component, the curvature of it should be formed beforehand. When seen from the front, the ends of the angle rafters of both sides are higher than the middle part and this curve shape is called vertical curves of eaves[anggok]. When seen from above, the ends of the angle rafters protrude outwards and this curve is called horizontal curves of eaves[anheorigok]. The lath on rafters is a 3 dimensional member that takes all of these forms into consideration. In the case of a double layered eaves, the lath on rafters on top of the rafters is especially called the lower laths on rafters[chomaegi], and the lath on rafters on top of the additional rafters is called the upper laths on rafters[imaegi].

5. shingle[gaepan]

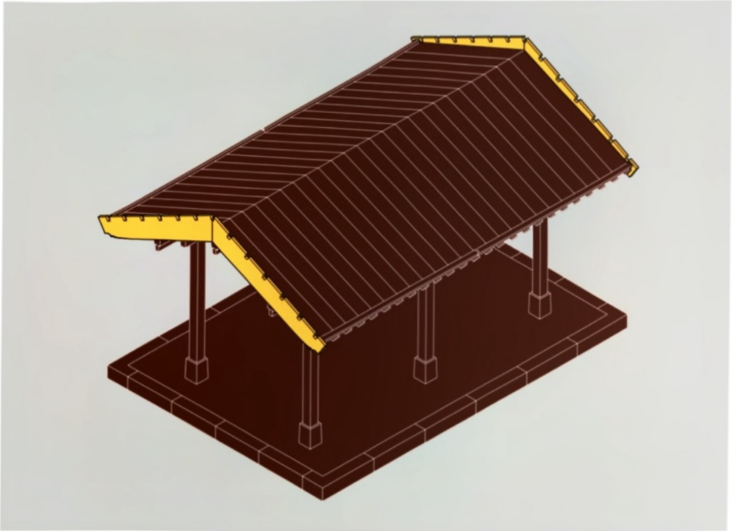
In order to place roof tiles on top of the regularly placed rafters or additional rafters that have a circular sectional shape, a flat surface should be made with planks that are called the shingle[gaepan]. These shingles are placed on the inner side of the laths on rafters in the same direction as the rafters. However, to place shingles, a large amount of wood is necessary, so for the common home, thin lattices called sanja are woven and placed instead. It is a made by weaving thin wood strips or sorghum straw with straw to make a similar flat surface like the shingles.



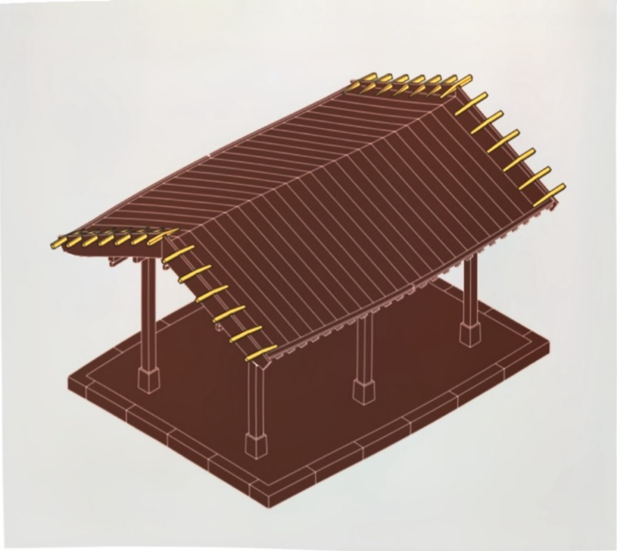
Shingles

6. barge board[bakgong]

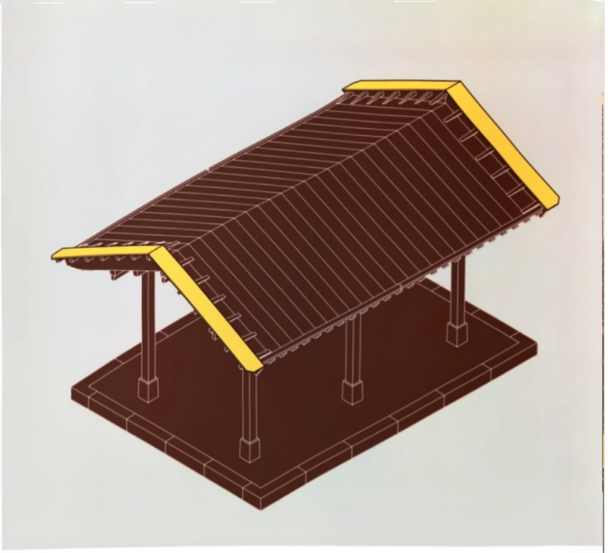
The barge board[bakgong] is a wooden board member that is put over the side surface of the gabled roof or the gable surface of the hipped-and-gabled roof. Its shape resembles the upside-down 'y' shape of the roof. It is fixed with nails from the purlins or rafters, and it is decorated on its top side by inserting a short rafter shaped component called the rafters on gable board[mokgiyeon] into a groove. Moreover, for the gabled roof, a wide wooden board called wind block[pungpan] is added under the barge board to block wind and rain.



Barge board



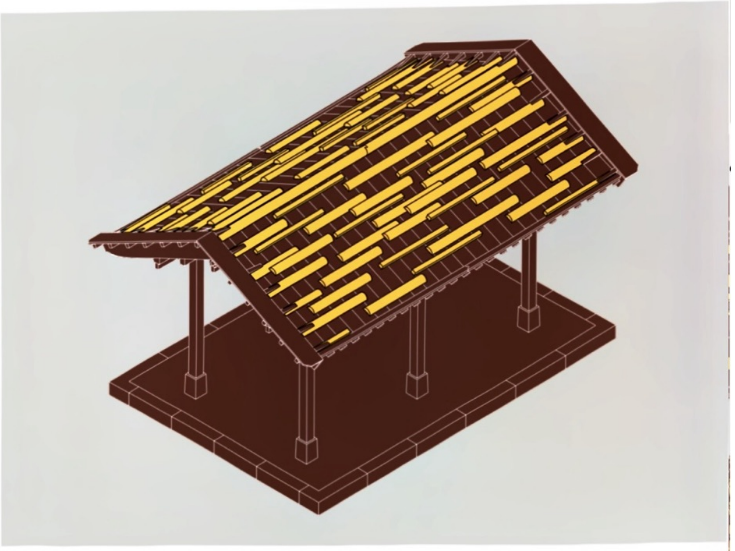
Rafters on gable board



Shingle for the rafters on gable board

7. roof filling wood[jeoksim]

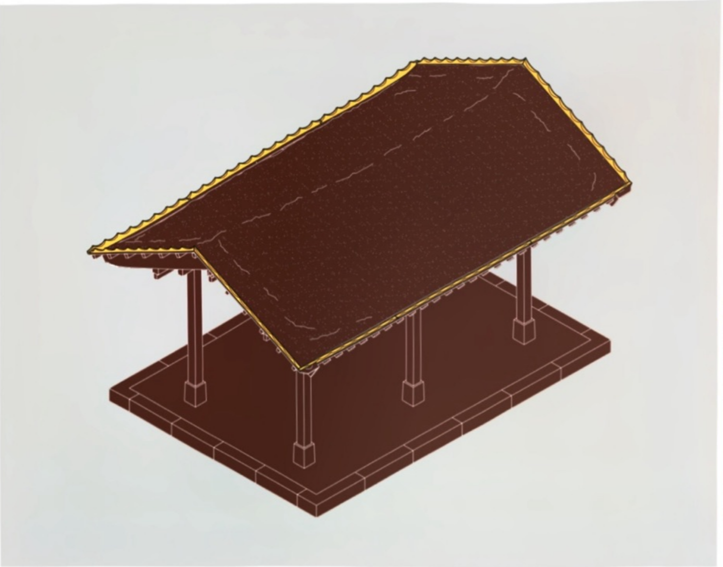
On top of the rafters and shingles, roof filling wood and soil are laid to weigh down on the rafters and at the same time, form the slope of roof[mulmae] of the roof. Leftover scrap wood after trimming members, or woods inadequate to use as main members can be used for the roof filling wood. These pieces of wood are relatively light in weight.



Roof filling wood

8. pan tile supporting laths[yeonham]

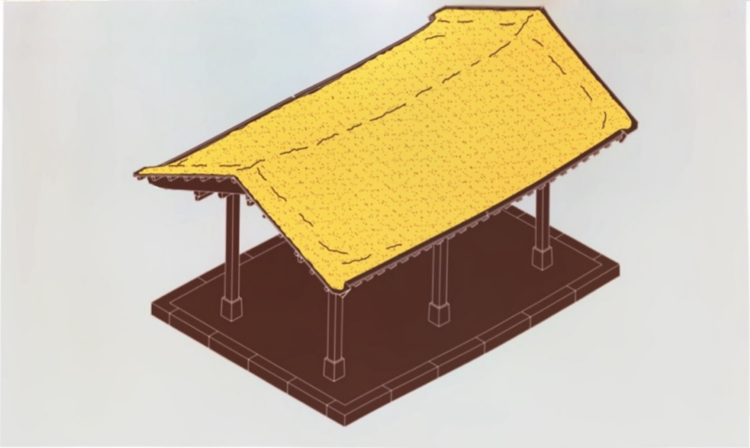
The pan tile supporting laths[yeonham] is a long horizontal member placed on top of the laths on rafters[pyeonggodae] and directly supports the roof tiles. Therefore the upper surface of the pan tile supporting laths[yeonham] is cut to the shape of the pan tiles, and the sectional surface is triangular.



Pan tile supporting laths

roof filling soil[boto]

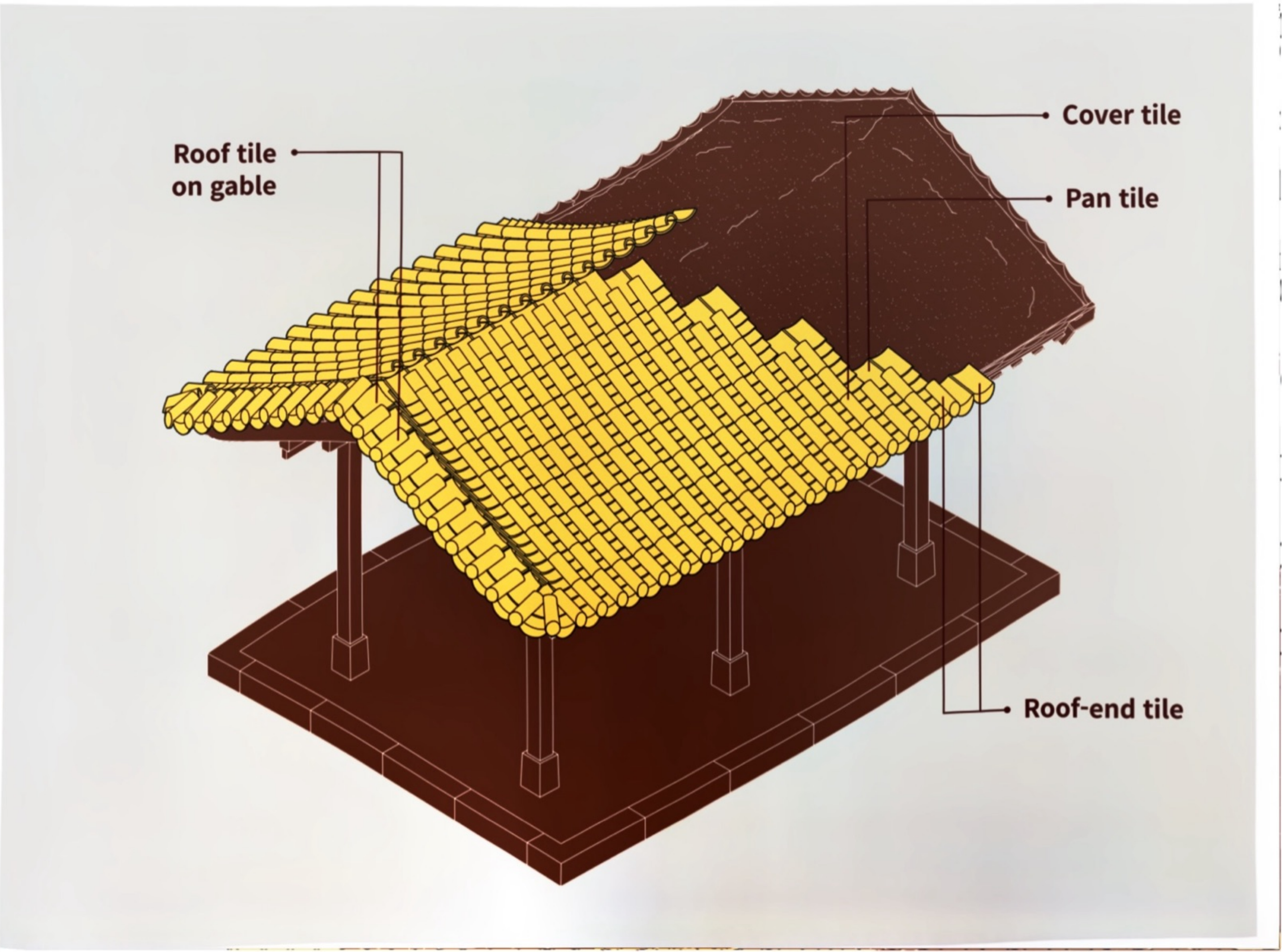
Gaps created after laying the roof filling wood are filled with soil to form the gradual slope of the roof. The soil used here is called either roof filling soil[boto] or almaeheuk. Slope of roof is called mulmae.

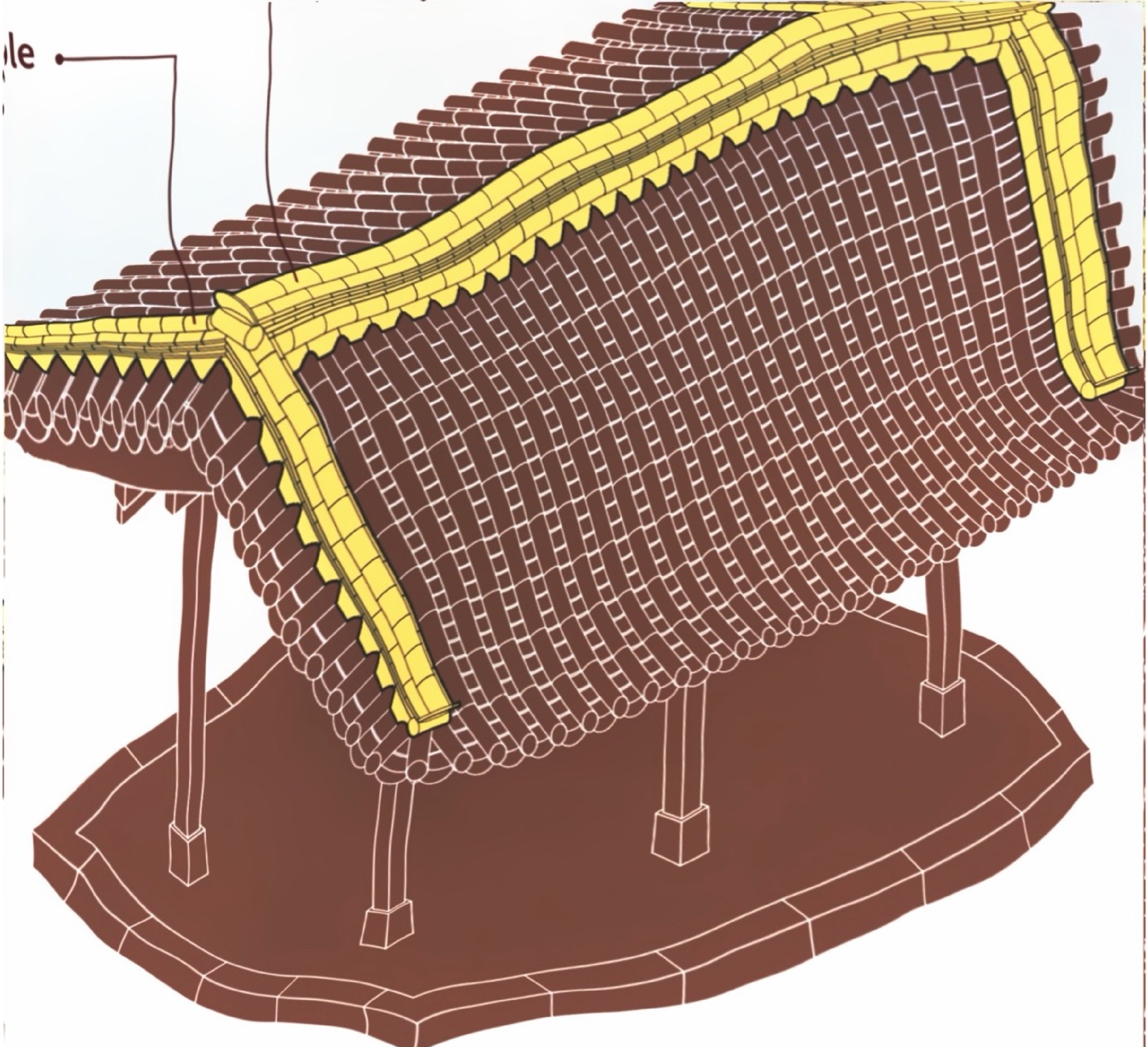


Roof filling soil

10. roof tile[giwa]

One of the materials that the roof can be covered with is roof tiles[giwa] which are baked roof tiles. Roof tiles are divided into two types, including pan tile[amkiwa] and cover tile[sukiwa] according to their shape and placement. The pan tile has a relatively gradual curve and is topped with the rounder cover tile. At the end of the eaves, a roof-end tile[maksaegiwa] is capped to cover the open side of the roof tiles. Other than this, there are various types of ornamental roof tiles, including the statue on roof[jabsang] that is placed on top of the ridge of the roof, the ridge-end ornamental tile[chimi] that decorates the end of the ridge, and the ridge-end tile[yongdu]. Also there are special roof tiles such as the roof tile on gable[neosaegiwa] that is placed next to the ridge on gable[naerimmaru].




gle

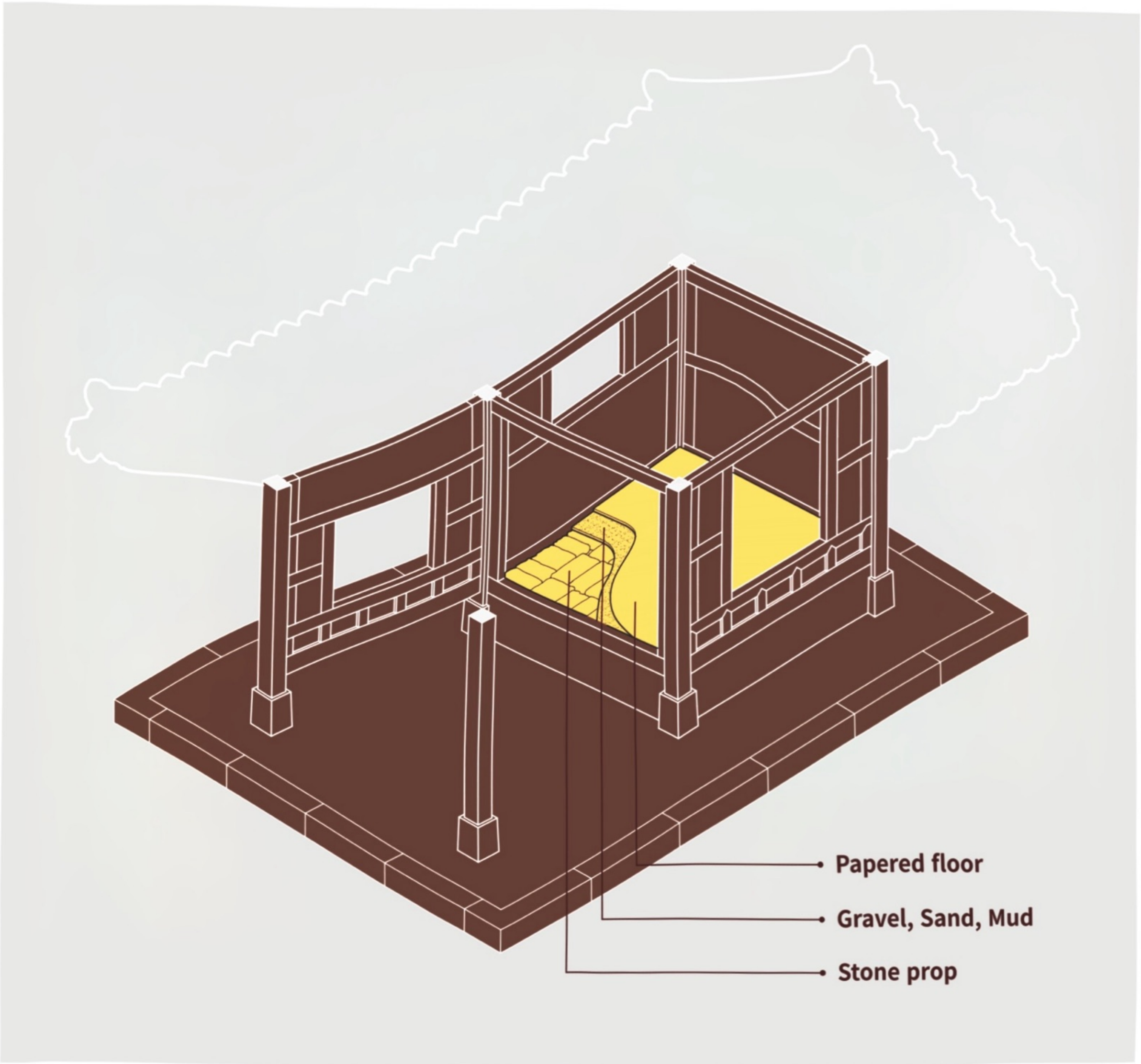
12

Ondol[ondol]

온돌[溫突] / 火炕[huǒkàng] / 温突[オンドル]

❶ Gudeul[gudle]

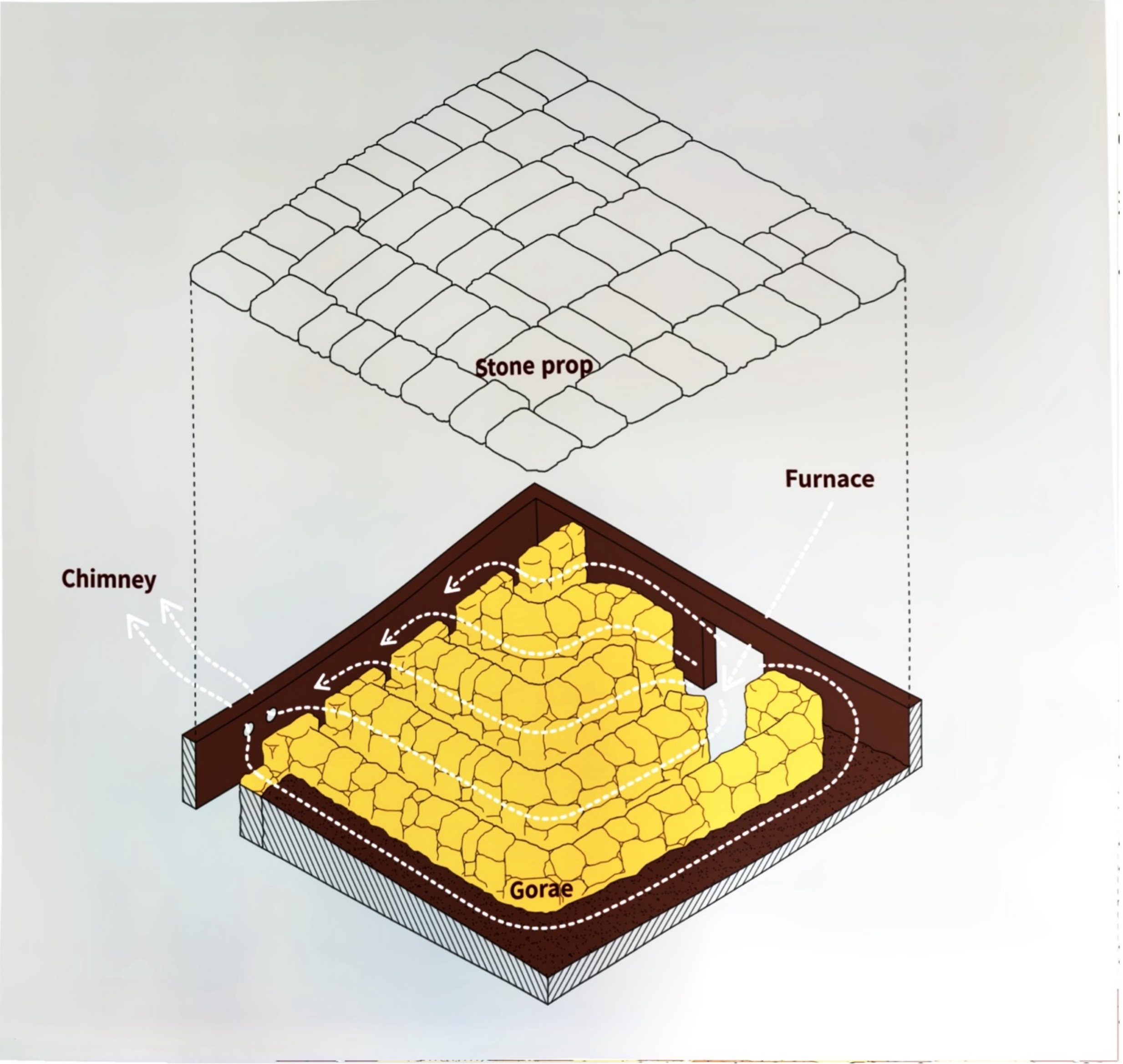
구들[炕] / 炕[kàng] / ——


Papered floor
Gravel, Sand, Mud
Stone prop

The 'Ondol[ondol]' is the Korean floor heating system. It is a system where the heat from the fire of the furnace[agungi] is transferred through the flue channel[gorae] and warms the stone prop[gudeuljang] above, so that the heat reaches the floor of the room. It was invented in the 12th century and spread throughout the Korean penninsula in the 17th century. With the Ondol, the floor of the Hanok can be warmed while having the floor a certain distance from ground to be sanitary. The Ondol is one of the most important components of the Hanok interior space along with the Maru and kitchen.

Gudeul[gudeul]

The term gudeul[gudeul] is commonly interchanged with Ondol. However, while Ondol refers to the overall heating system, including gudeul, the gudeul indicates the specific structure that is composed of the flue channel[gorae] and stone prop[gudeuljang].



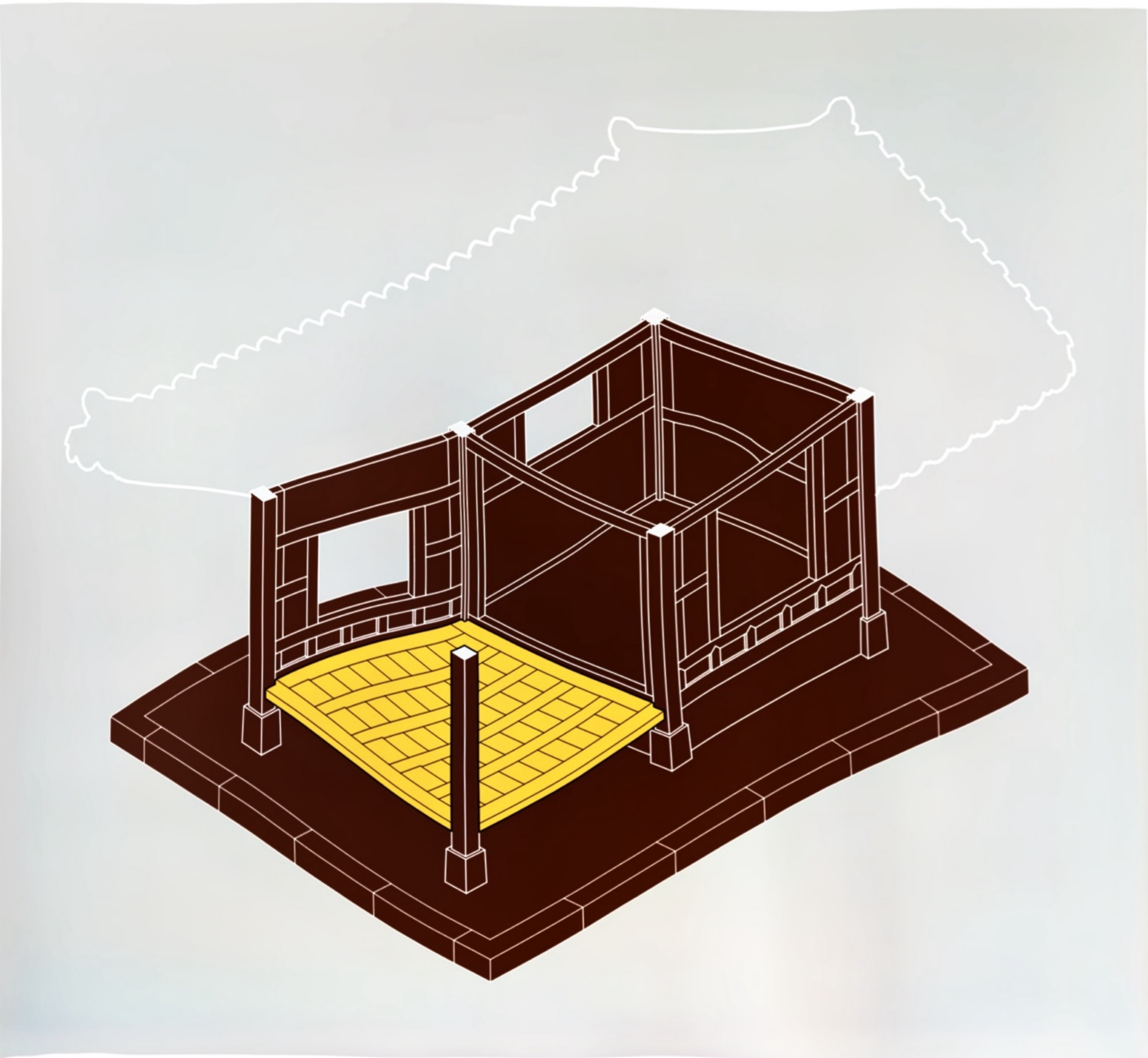
13

Maru(maru)

마루[抹樓, 廳] / 木地板[mùdìbǎn] / 板床[いたゆか], 板敷[いたじき]

❶ **floor joist**[gwiteul]
귀틀[耳機] / —— / 根太[ねだ]

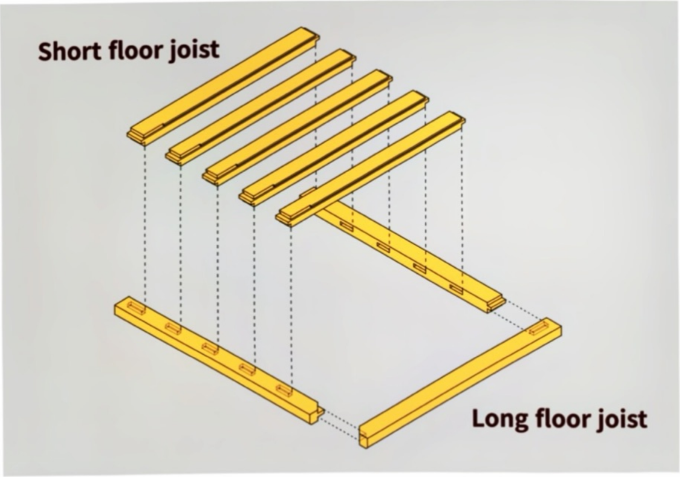
❷ **floor board**[cheongpan]
청판[廳板] / —— / 床板[ゆかいた]



The 'Maru[maru]', along with the Ondol, is a primary component of the interior space of the Hanok. The Maru indicates both the wooden-floored space that is offset from the ground and the wooden-floor itself. There are various types of Marus according to their location. Main wooden-floored hall[daecheong] is typically a large Maru in between rooms, narrow wooden porch [toetmaru] is located in the half-sized side bay[toekan] and serves as a buffer space like a hallway. Additional wooden floor[jjokmaru] is narrowly added outside of the common column's[pyeongju] row. Raised wooden floor[numaru] is offset higher from the ground than other Marus to serve as a pavilion-like space etc. In addition, Marus with long, narrow floor boards laid longitudinally alike the floorboard are called wooden floor with planks[jangmaru], and Marus that use relatively short floor boards laid in a '#' shape are called checkered wooden floor[umulmaru], which is also the most typical and original method of the Hanok.

1. floor joist[gwiteul]

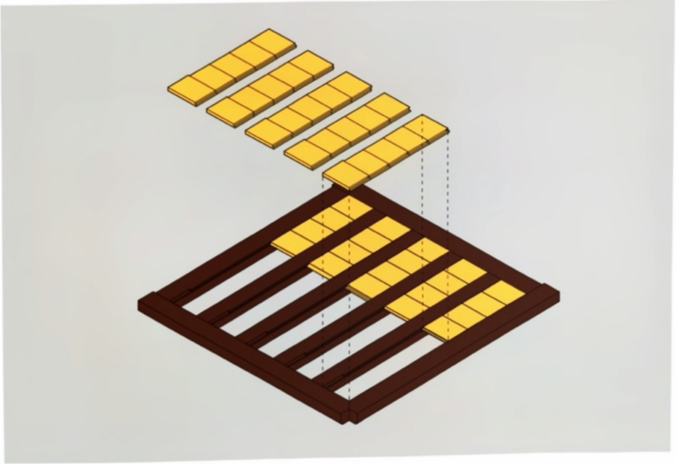
The basic frame for the checkered wooden floor[umulmaru] is called the gwiteul. The long floor joist[janggwiteul] connects columns at the front and back of the Hanok with long floor boards, and the short floor joist[donggwiteul] connects the long floor joist perpendicularly with shorter floor boards.



Floor joist

2. floor board[cheongpan]

The floor board[cheongpan] is the floor board that is inserted into the floor joist and closes the gaps of the checkered wooden floor frame. It is inserted into grooves on the side of the short floor joist.



Floor board

14

railing[nangan]

난간[欄干] / 栏杆[lángān] / 高欄[こうらん]

❶ flat railing[pyeong-nangan]
평난간[平欄干] / —— / ——

❷ protruding railing[gyeja-nangan]
계자난간[鷄子欄干] / —— / ——

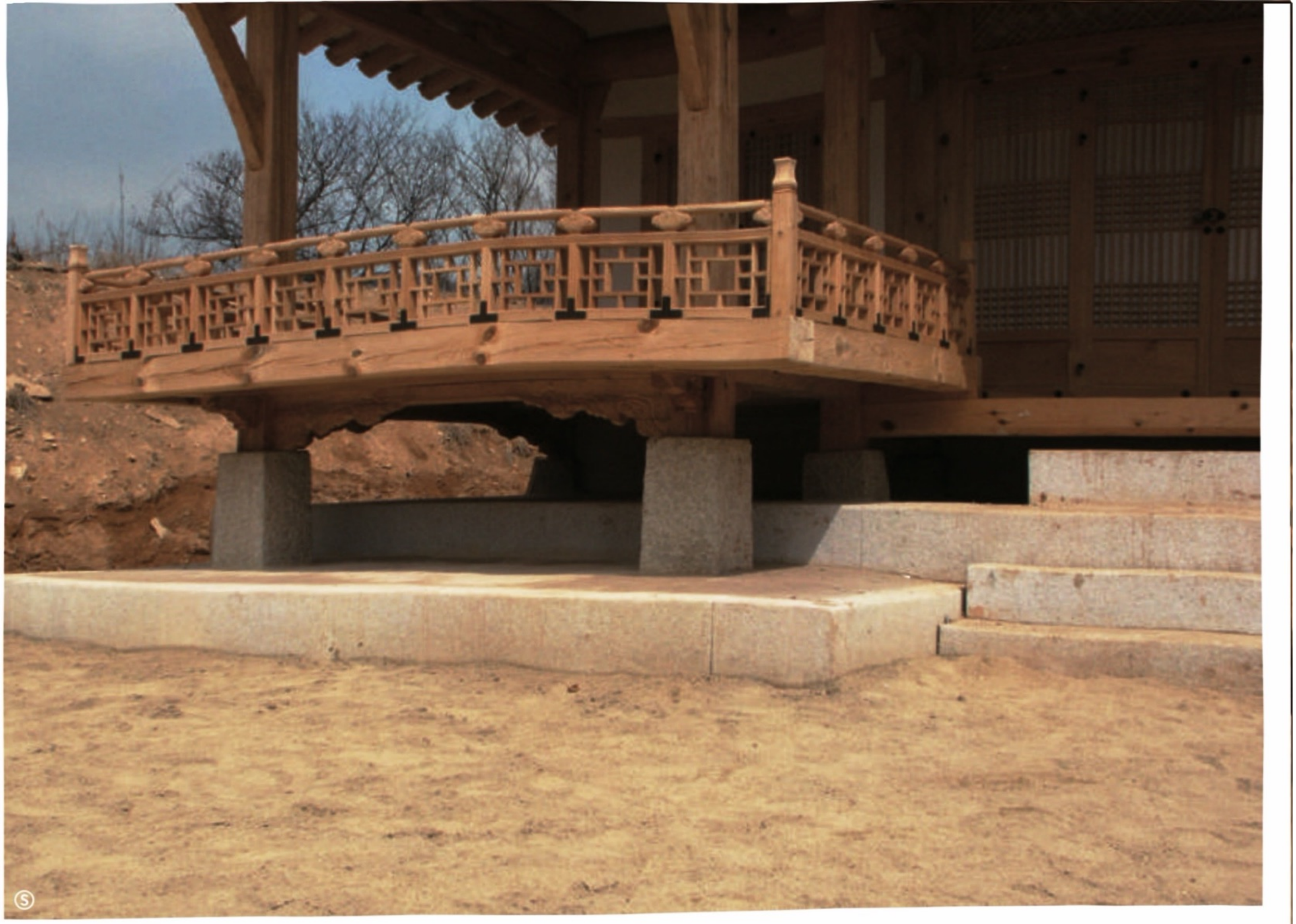
The ‘railing[nangan]’ is a railing that is placed on the edge of space without walls such as the narrow wooden porch[toetmaru] or raised wooden floor[numaru] so that users do not fall over.

1. flat railing[pyeong-nangan]

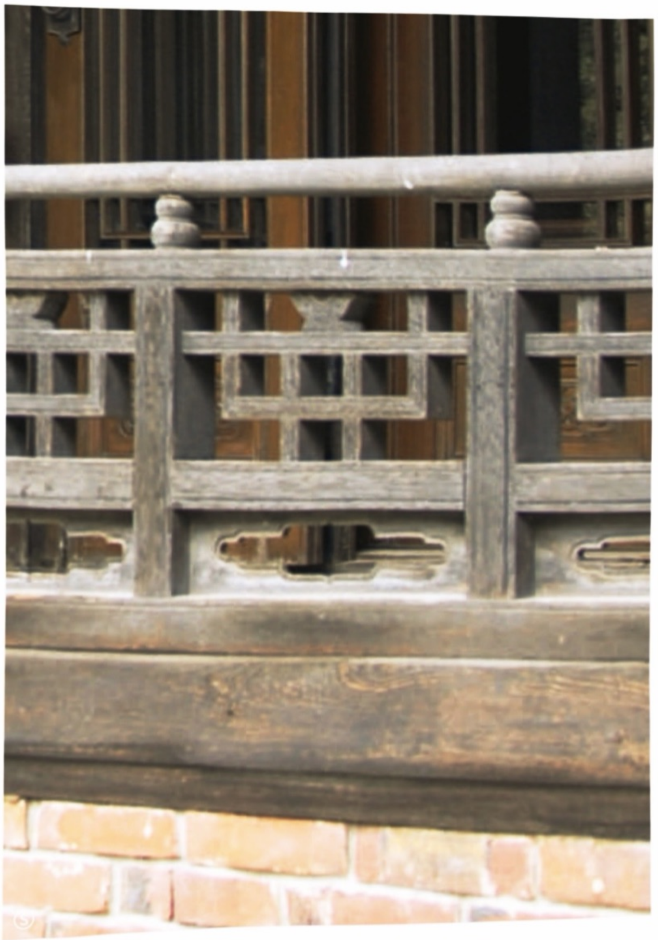
The flat railing[pyeong-nangan] is a railing that is raised perpendicularly along the edge of the floor. Place baluster[nangandongja] in between the top and bottom rails[nangandae] and the space in between is filled with flat boards[cheongpan], or railing bars of various shapes.

2. protruding railing[gyeja-nangan]

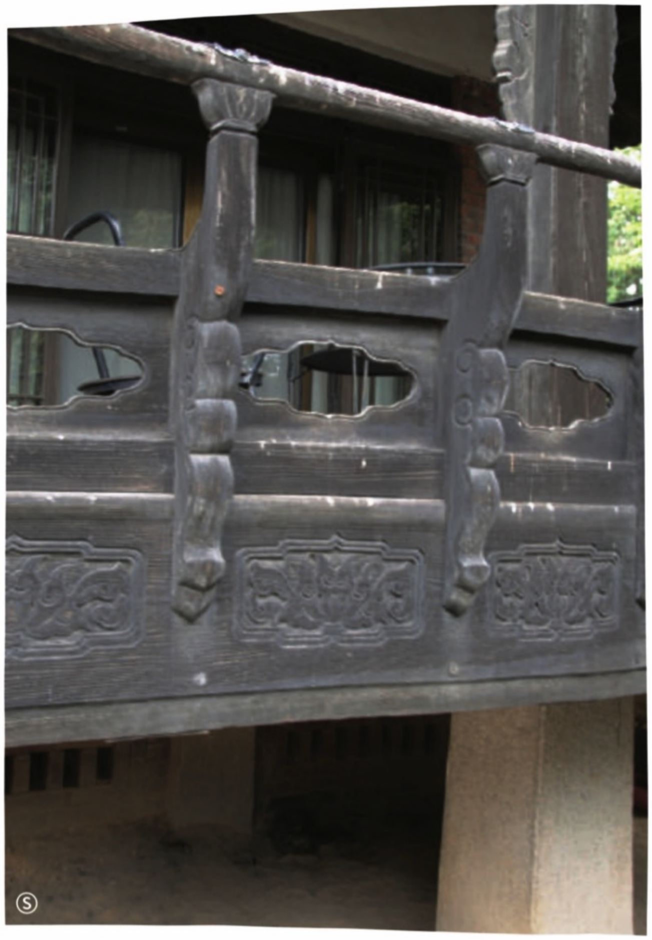
The protruding railing[gyeja-nangan] is a railing type commonly used for the Hanok. It is named because the baluster[nangandongja] resembles a chicken leg, so this type of baluster is particularly called the gyejadari. When seen from the side, the top and bottom rails do not align; the top rail is placed outwards along the shape of the chicken-leg shaped baluster. Accordingly a more spacious space is created because the top nangandae does not get in the way of the users hand from inside the railing[nangan]. Unlike the flat railing, an additional board under railing called chimaneol is attached to the bottom of the baluster.



Railing



Flat railing



Protruding railing

15

wall frame components[sujangjae]

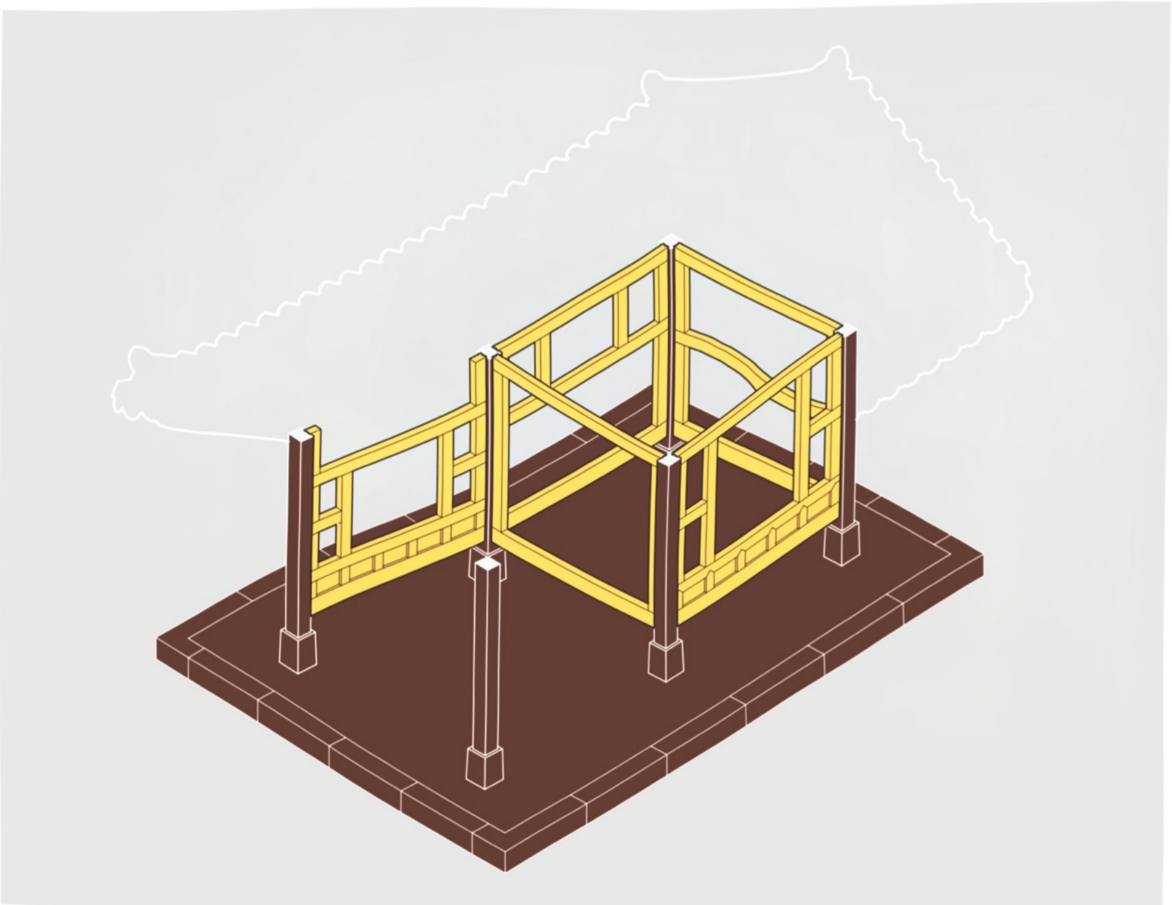
수장재[修粧材] / 装修[zhuāngxiū] / 意匠材[いしょうざい]

❶ lintel[inbang]
인방[引枋] / 槛[kǎn] / 貫[ぬき]

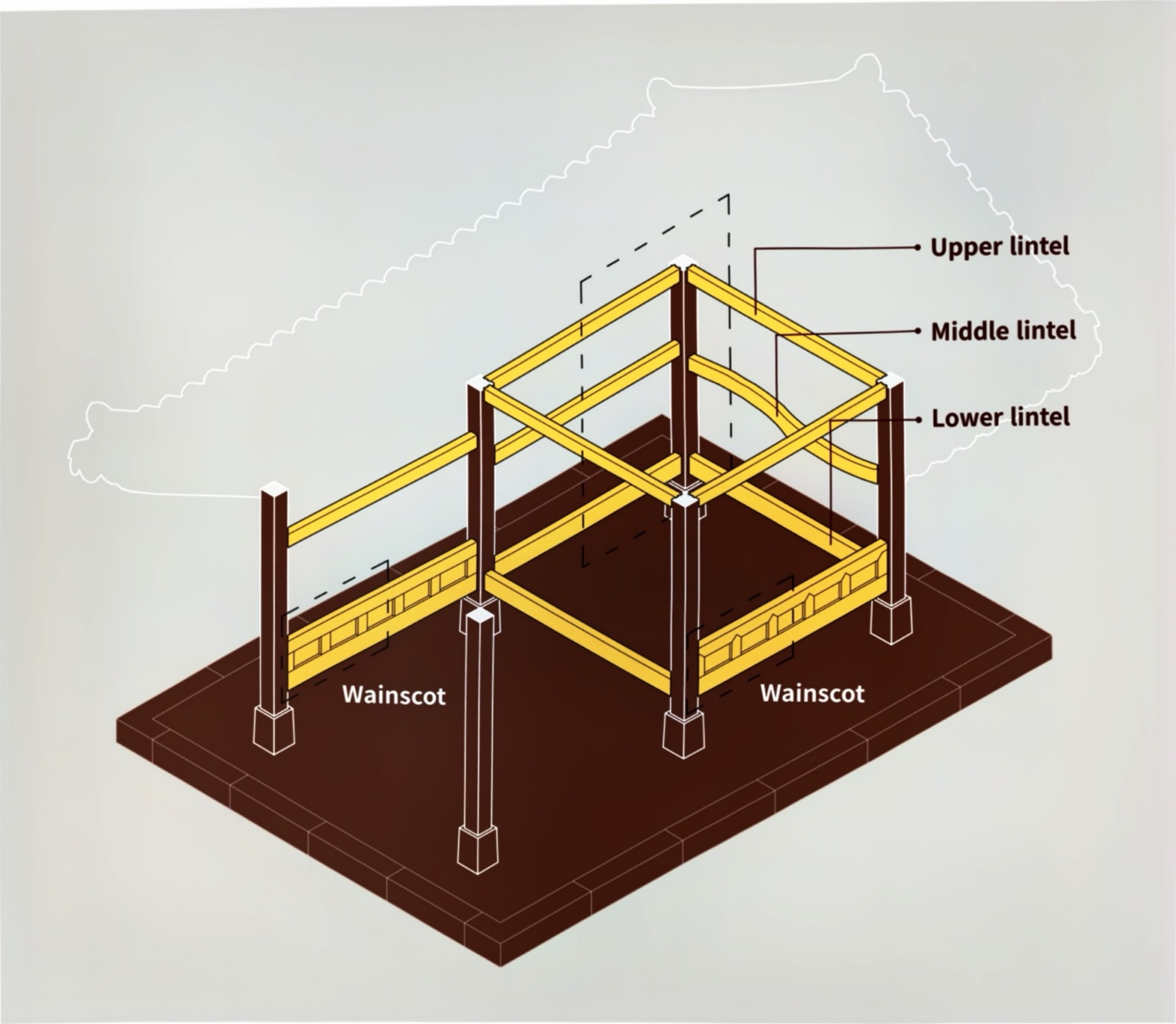
❷ wainscot[meoreum]
머름[遠音] / —— / 腰板[こしいた]

❸ wall stud[byeokseon]
벽선[壁楦] / 抱框[bàokuàng] / 方立[ほうだて]

❹ jamb[munseon]
문선[門楦] / 大边[dàbiān] / 幣軸[へいじく]

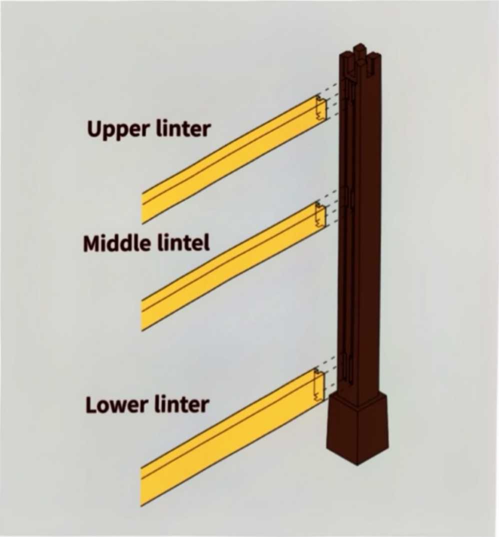


The 'wall frame components[sujangjae]' refer to the wall frame components that have the same thickness. Because the Hanok is a post-and-lintel construction, the beams and columns serve as the structure while the wall frame components fix the walls down and serve as a buffer in the space between the beam, column, and the wall.


Upper lintel
Middle lintel
Lower lintel
Wainscot
Wainscot

Lintel, Wainscot

1. lintel[inbang]

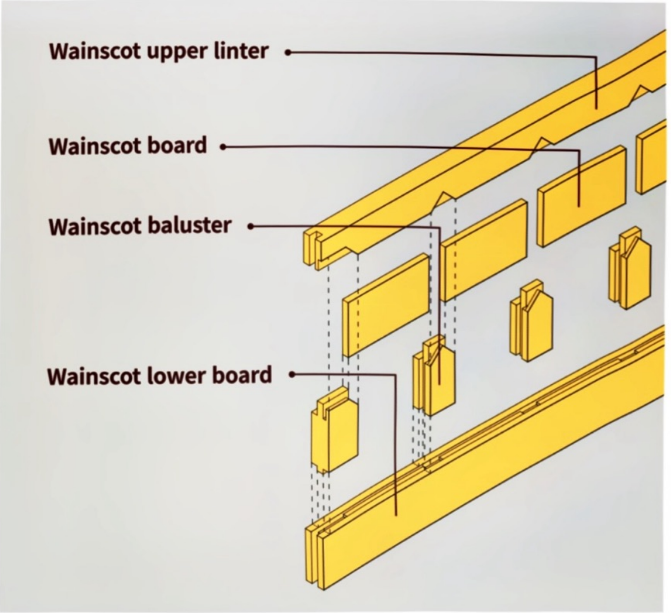

Upper linter
Middle lintel
Lower linter

Types of lintel

The lintel[inbang] is a horizontal component that connects the space in between columns. Usually in one wall, there are the upper lintel[sanginbang], middle lintel[junginbang], lower lintel[hainbang] to support the space in between two columns. When the opening is used as a door or window in the wall, the lower lintel[hainbang] is especially called the threshold[munjibang].

2. wainscot[meoreum]

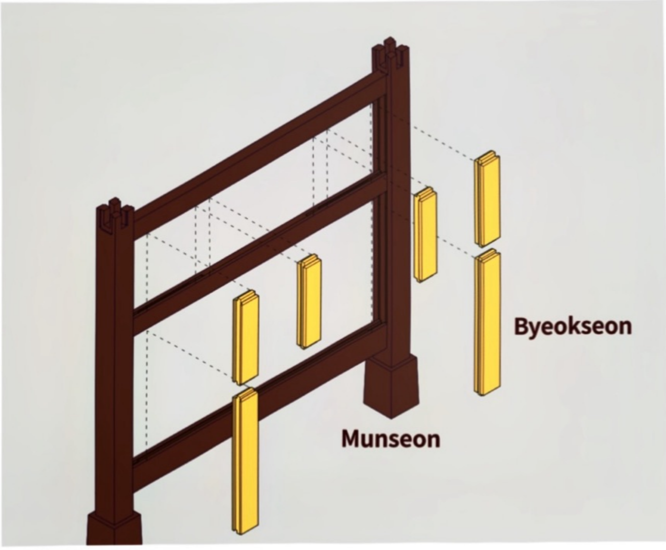
When a window is inserted, the lower lintel is called the meoreum just as if when a door is inserted, the lower lintel is called munjibang. The wainscot is installed higher than the normal lintels so that in a sitting position, it would be comfortable to perch an arm on it. A wainscot upper lintel[meoreum-sangbang] and wainscot lower lintel[meoreum-habang] is placed in between columns, and wainscot balusters[meoreum-dongja], and wainscot boards[meoreum-cheongpan] are inserted to and decorate the gaps in between.



Elements of wainscot

3. wall stud[byeokseon]

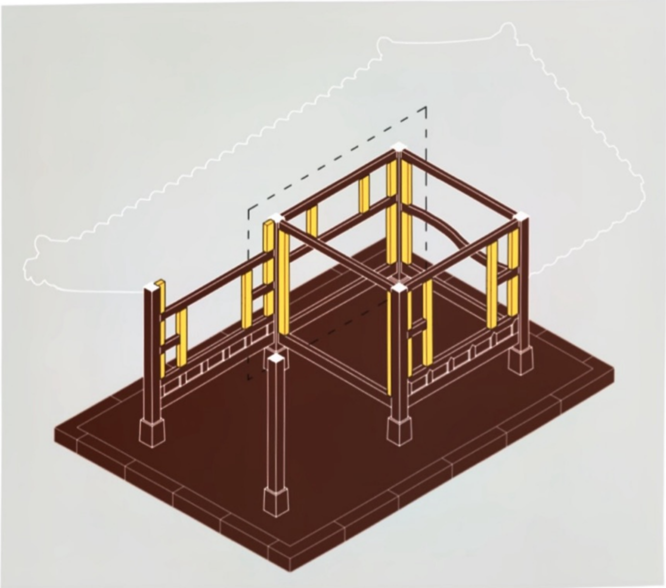
The wall stud[byeokseon] is a vertical component that is attached to the side of the column and is connected to the lintel[inbang]. With the lintel[inbang], it is a primary component of the basic wall frame.



Wall stud

4. jamb[munseon]

The jamb[munseon] is a vertical component attached to the side of the door or window. Lintels are assembled on the top and bottom of the jamb[munseon].



Jamb, Wall stud

16

choosing site[teo-japgi]

터잡기 / 选址[xuǎnzhǐ] / 土地を決める[とちをきめる], 占地[せんち]

❶ site[teo]
터 / 基址[jīzhǐ] / 敷地[しきち]

❷ Feng Shui[pungsu]
풍수[風水] / 堪與[kānyú], 风水[fēngshuǐ] / 風水[ふうすい]

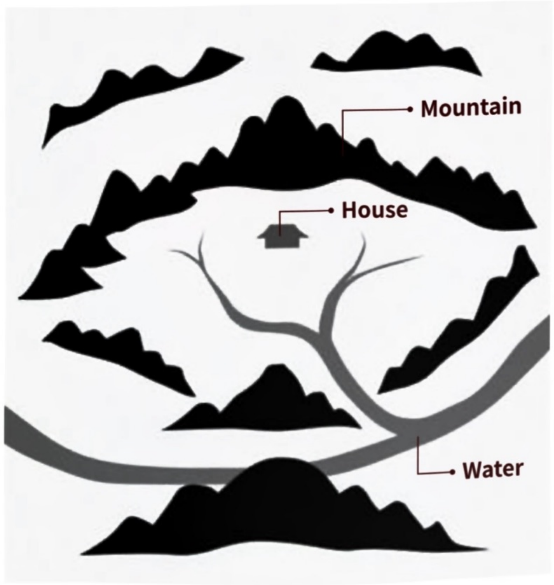
❸ location[bokgeo]
복거[卜居] / 卜居[bojū] / 卜居[ぼっきょ]

❹ orientation[jwahyang]
좌향[坐向] / 朝向[cháoxiàng] / 向き[むき]

‘Choosing site[teo-japgi]’ refers to the process of selecting the site before building the Hanok.

1. site[teo]

Site[teo] refers to the site for construction of Hanok and also means the basis of a work process. When choosing the site for the Hanok, it is important to have a comprehensive understanding of the site.



Site selection

2. feng shui[pungsu]

Feng Shui[pungsu] is the theory in which the topography of a site is comprehended and linked to the fortunes and misfortunes of human. From long ago, wind and water were essential conditions in choosing a dwelling area, so analyzing the mountains and waters in the surroundings of the building was a very important procedure. The mountains to be considered include that in the back of the site, in the front of the site, and in the far front of the site. A good site, according to Feng Shui[pungsu], has a mountain in the back to enclose the site and another in the front in a stable form to support the back mountain. Also there should be a meandering river that has the site in its center. Between the river and the site, there is a low mountain that somewhat blocks the energy of the river. The geography literature, *《Taengniji(擇里志)》* and *《Sallimgyeongje(山林經濟)》*, both written in the Joseon Dynasty period, illustrate the conditions of a good site according to Feng Shui.

3. location[bokgeo]

Location[bokgeo] means to choose a place to dwell for a long time. In *《Taengniji(擇里志)》* it is said that a good location has geographical, economical, neighborly, and scenic conditions in harmony. In other words, it should be geographically comfortable, an adequate place to make a living, without bad conventions, with good people, and a nature landscape that can clear the mind so that one can dwell for a long time.

4. orientation[jwahyang]

While location[bokgeo] is choosing a good location, orientation[jwahyang] is deciding the orientation of the Hanok. The viewpoint from inside the Hanok toward its surroundings is an important element when choosing an appropriate site.

❺ **quicklime foundation**[saengseokhoejapseok-jijeong]

생석회잡석지정[生石灰雜石地定] / —— / 石灰地業[せっかいじぎょう]

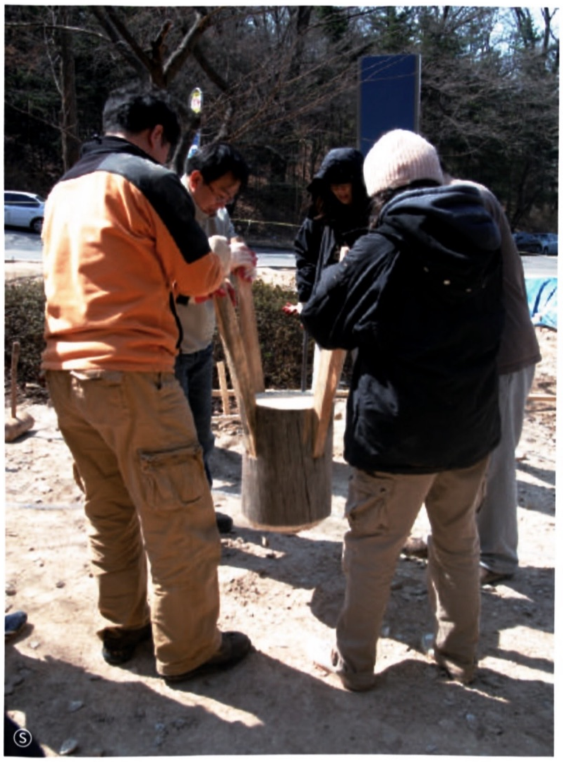
The 'building foundation[jijeong]' refers to the foundation not only of the Hanok building but also of the entire building territory and also refers to the process of laying this foundation. It is the groundwork of digging or mounting earth to form an adequate land to raise a Hanok. There are various types depending on the materials involved.

1. rammering[dalgujil]

The tool to firmly tramp the earth or stone down is called the dalgu, and the work of using the dalgu to ram the ground is called dalgujil. Usually there are two to four long and solid handles so that two or more people can lift and pound down with the log to harden the ground.

2. sand foundation[morae-jijeong]

The sand foundation[morae-jijeong] is a foundation type made by digging out soil and filling with layers of sand hardened with water.



1 2 — 1 Rammering 2 Compacting
3 3 Quicklime foundation

3. rectangular stone foundation[jangdaeseok-jijeong]

The rectangular stone foundation[jangdaeseok-jijeong] is a foundation type with rectangular stones laid in a grid pattern and covered with stone plates. It is a foundation type used for buildings of significance.

4. grave foundation[jeoksimseok-jijeong]

The grave foundation[jeoksimseok-jijeong] is a foundation type made by laying round rubble and ramming.

5. quicklime foundation[saengseokhoe-japseok-jijeong]

The quicklime foundation[saengseokjoe-japseok-jijeong] is a foundation type that is made by laying out rubble stones, filling the spaces in between with quick lime and soil, and lastly, ramming. This type of foundation is commonly used today.

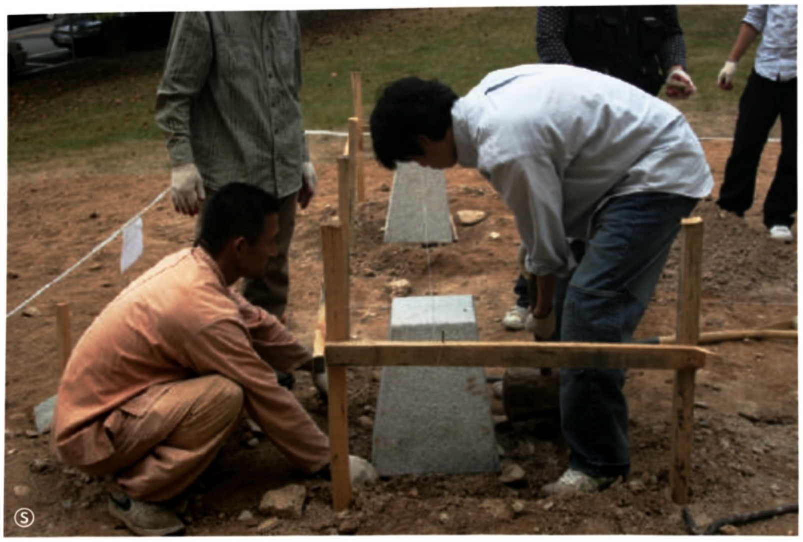
18

laying column base stone[jeongcho]

정초[定礎] / —— / 定礎[ていそ]

❶ stretching cord[sil-ttuiwugi]
실 띄우기 / 弹线[tánxiàn] / 水盛り遣り方[みずもりやりかた]

'Laying column base stone [jeongcho]' refers to the process of placing column base stones after laying the building foundation. It is the first step in the planar conformation of the Hanok and is considered an important process, so the date of jeongcho is arranged in advance with the column erecting and framework completion.



Placing column base stone

stretching cord[sil-ttuiwugi]

Stretching cord[sil-ttuiwugi] refers to the process of suspending strings perpendicularly on the batter boards where the column base stones are to be raised in order to adjust the location and height of the column base stones. The crossing of the strings should align with the center of the ink lines marked on the column base stones so that the column base stone is placed in the exact location.

19

timberwork[chimok]

치목[治木] / 荒料[huāngliào] / 木材加工[もくざいかこう]

❶ cutting timber[mareumjil]
마름질 / 打截料[dǎjiéliào] / 玉切り[たまきり]

❷ dressing timber[basimjil]
바심질 / 砍刨[kǎnbào] / 木取り[きどり]

❸ trimming timber[gasimjil]
가심질 / 凿眼整齐[záoyǎnzhěngqí] / 仕上げ[しあげ]

❹ fitting for connection[geurejil]
그레질 / —— / 光付け[ひかりつけ]

Timberwork

'Timberwork[chimok]' refers to the process of trimming all of the wooden members to their need. This process requires accuracy because the forms and joints of members differ by location and usage, and members should join together closely without any gaps. The direction of timberwork depends on the usage of the timber and should be decided after observing the bends and cracks, top and bottom direction, concave and convex shape of the timber. The Korean land pine which is commonly used for Hanoks grow twistingly in a clockwise direction, so bending is inevitable and irregular drying shrinkage occurs accordingly, resulting cracks. These conditions of the timber should be considered when trimming timbers of different usages. Also principally the original top and bottom of the timber should be retained. Moreover, the timber should be arranged appropriately where the naturally convex and concave shape of a bend can be utilized.

1. cutting timber[mareumjil]

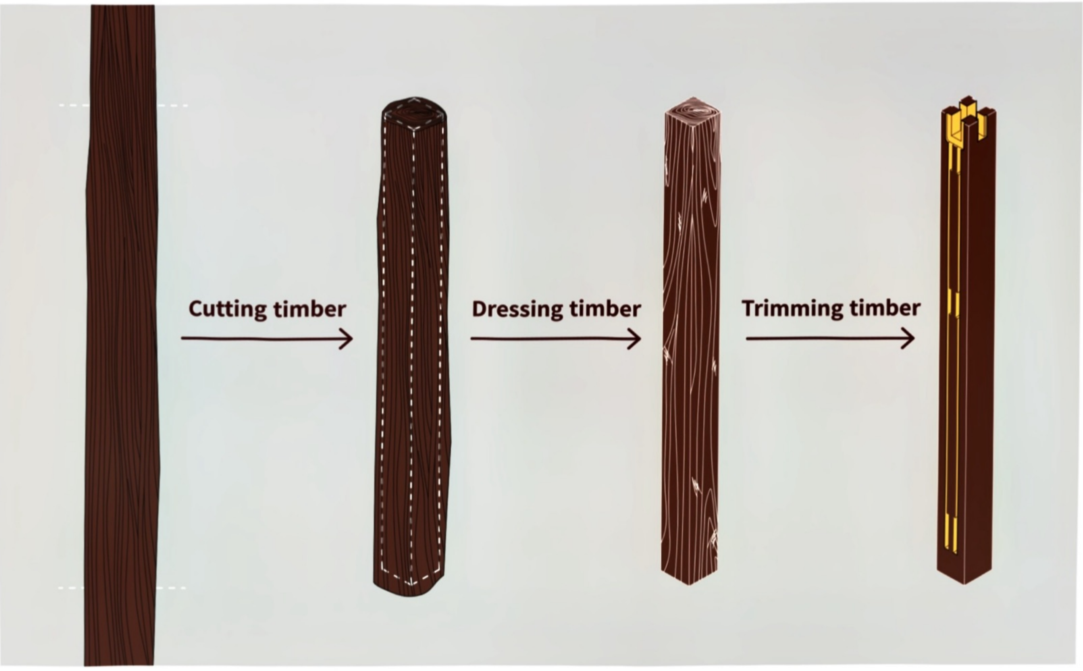
Timberwork can be divided into several processes in the order of cutting timber[mareumjil], dressing timber[basimjil] and trimming timber[gasimjil]. Cutting timber[mareumjil] is the process of marking and cutting the timber to a needed length.

2. dressing timber[basimjil]

After cutting timber, dressing timber[basimjil], the process of marking and dressing the timber to its specific shape, is carried out.

3. trimming timber[gasimjil]

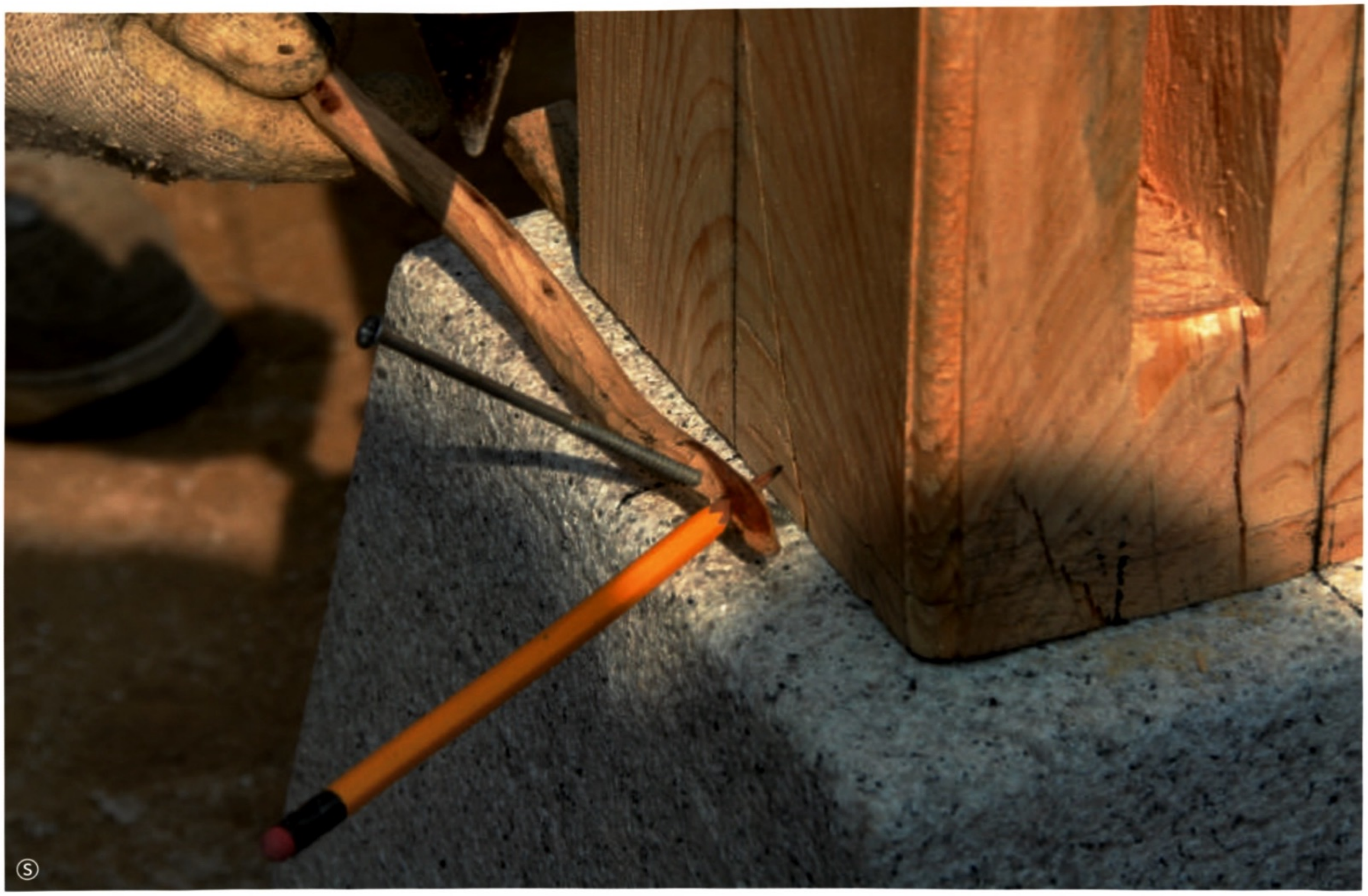
Trimming timber[gasimjil] is the last step of timberwork and is the process of smoothing the surface of the timber with a plane or chisel.



Timberwork for columns

4. fitting for connection[geurejil]

Fitting for connection[geurejil] is needed when trimming the bottom of columns or where a member meets horizontally with another member to the shape of the corresponding member. Fitting for connection is the process of fitting two components for connection by tracing the shape of one member on the other to match the surfaces that meet. It is usually done when trimming the shape of the column base stone onto the bottom of the column that will be raised on top.



Fitting column base stone and column

20

joinery[gyulgu]

결구[結構] / 结构[jiégòu] / 納まり[おさまり]

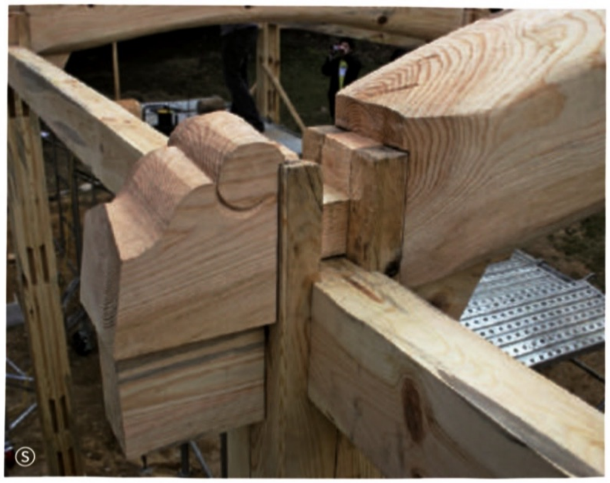
❶ cross joint[matchum]
맞춤 / 榫卯[sǔnmǎo] / 仕口[しぐち]

❷ longitudinal joint[ieum]
이음 / —— / 継手[つぎて]

❸ floor joint[jjokmae]
쪽매 / —— / 矧[はぎ]

❹ tenon[jangbu]
장부 / 榫[sǔn] / 枘[ほぞ]

❺ cheek[teok]
턱 / 鼻子[bízi] / 顎[あご]



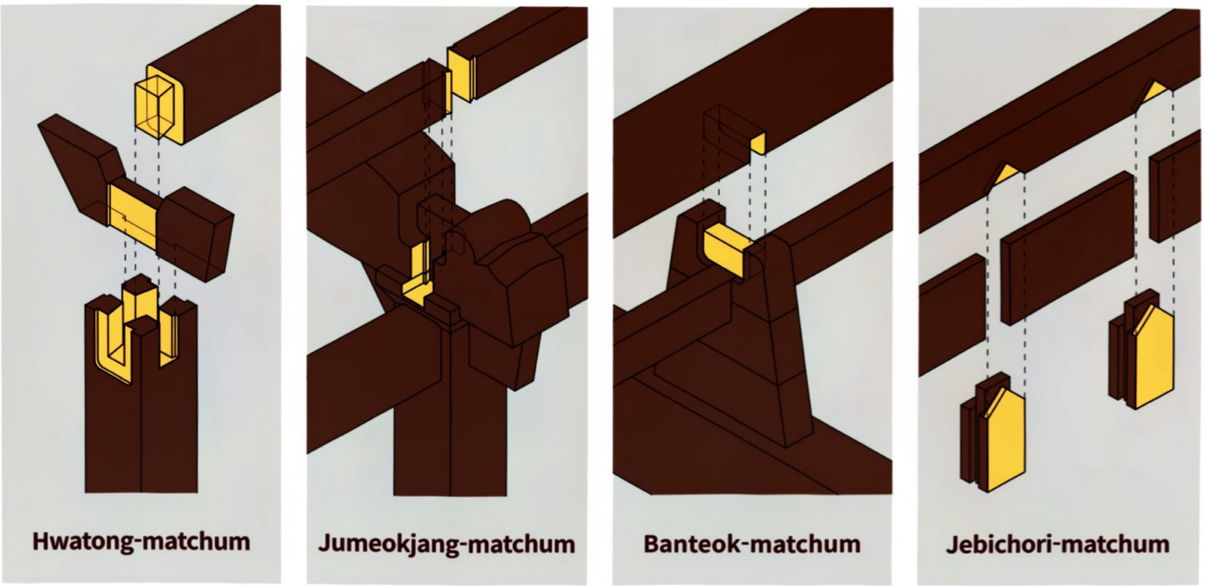
'Joinery[gyeolgu]' refers to the act of joining wooden members or that joinery. Because members of various forms join together from all directions to form the structure, there are various types of joining methods. Joinery[gyeolgu] methods are largely categorized into cross joint[matchum], longitudinal joint[ieum], and floor joint[jjokmae].

1. cross joint[matchum]

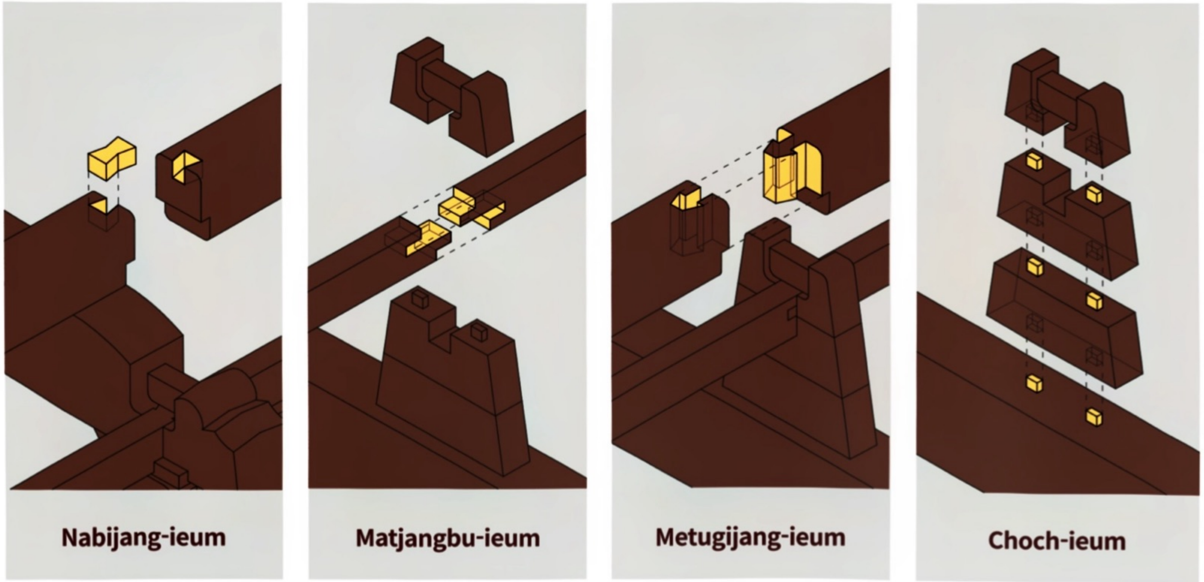
Cross joint[matchum] is a joinery used where members meet perpendicularly or diagonally. The most typical joints are the two-way T-bridle joint[hwatong-matchum] which is used for joining the upper girders[changbang] and beams to the upper part of the column, and the halving joint[banteok-matchum], where the joints are carved half the length of each member. There are many other types of cross joints, including the dovetail joint[jumeokjang-matchum] and mortise and tenon joint[jangbu-matchum].

2. longitudinal joint[ieum]

Longitudinal joint[ieum] is a joinery used where long members meet longitudinally. It is used for joining purlins on the top of the column or upper girders[changbang]. Alike the cross joints,


Hwatong-matchum
Jumeokjang-matchum
Banteok-matchum
Jebichori-matchum

Types of cross joint


Nabijang-ieum
Matjangbu-ieum
Metugijang-ieum
Choch-ieum

Types of longitudinal joint

there are various types of longitudinal joints, including the dovetail joint[jumeokjang-i-eum] and the mortise and tenon joint[jangbu-i-eum] where a tenon[jangbu] and mortise[jangbu-gumeong] are carved into each member and joined together.

3. floor joint[jjokmae]

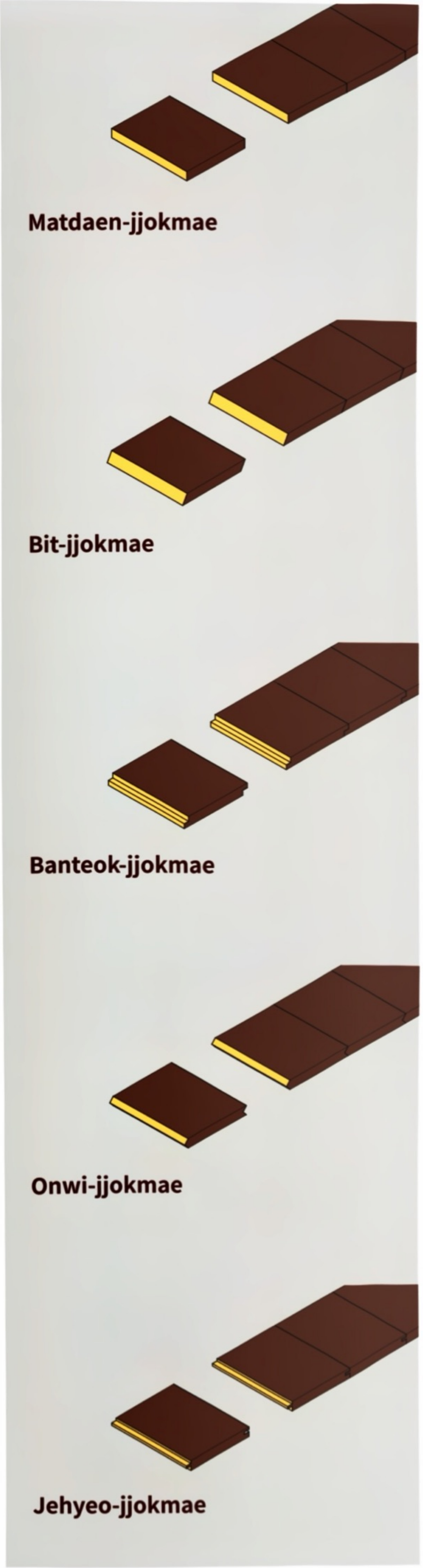
Floor joint[jjokmae] is a joinery that connects the sides of boards to make a wide surface and is used for laying the floorboards[cheongpan] of the Maru. The matdaen-jjokmae is joining members by simply laying them side by side. Depending on the way of carving and joining, the boards various floor joints include the shiplap joint[banteok-jjokmae], where a lap is carved into each member and the tongue and groove joint[jehyeo-jjokmae], where a long tongue is carved into the members.

4. tenon[jangbu]

The tenon[jangbu] refers to the long and thin tenon that is carved to insert the member into another member. It is also called a chok. The hole where this tenon is inserted into is called the jangbu-gumeong(mortise). This is a joinery widely used with both cross joints and longitudinal joints.

5. cheek[teok]

With the tenon, the cheek[teok] is used for many joints and refers to the part of the member that is slightly higher than the other surfaces so the member can interlock with another member. There are various types of cheeks depending on its shape including the shiplap joint[banteok], and the cogged joint[geolchimteok].


Matdaen-jjokmae

Bit-jjokmae

Banteok-jjokmae

Onwi-jjokmae

Jehyeo-jjokmae

Types of floor joint

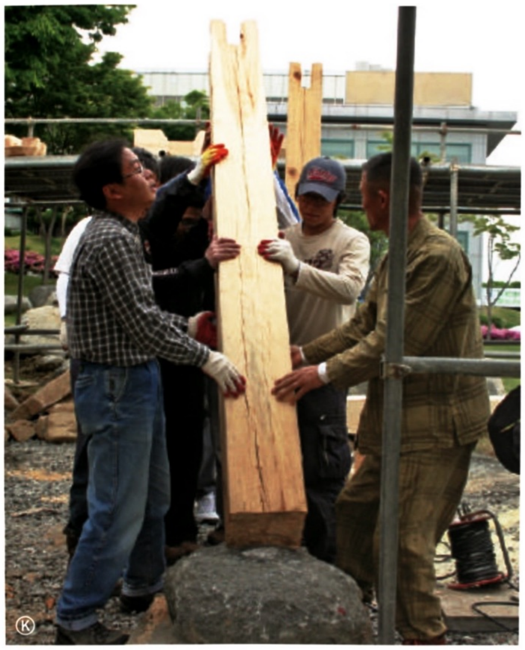
21

erecting column[ipju]

입주[立柱] / —— / 柱立て[ばしらだて]

❶ checking verticality[darim-bogi]
다림보기 / 吊直拔正[diàozhíbázhèng] / 下げ振りで垂直を確認する[さげふりですいちょくをかくにんする], 縦水[たちみず]

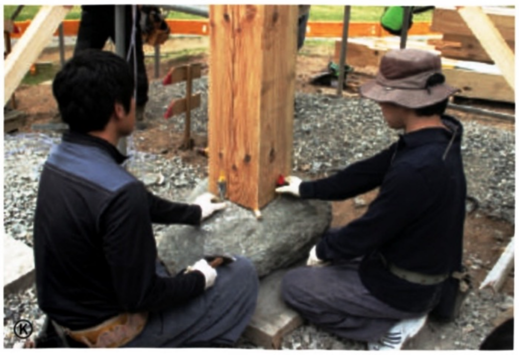
'Erecting column[ipju]' refers to the process of raising columns on top of the column base stones after the timberwork is finished. Because it is the first step of raising the Hanok frame, to recognize its significance, a column erecting ceremony [ipjusik] is held. It is important to consider the location of the columns, the directions in which other members are to be joined with the columns, and how to raise the columns perpendicularly on the rough base stone.



Erecting column

checking verticality[darim-bogi]

Checking verticality[darim-bogi] is the process of checking the perpendicularity of the column with a plumb bob[darimchu] when raising the column that has been carved according to the surface shape of the foundation stone[geurejil]. By dropping the plumb bob from the top of the column along the front and side surface, one can see if the column is perpendicular. The string of the plumb bob should be exactly aligned with the center ink line that has been marked on the column beforehand.

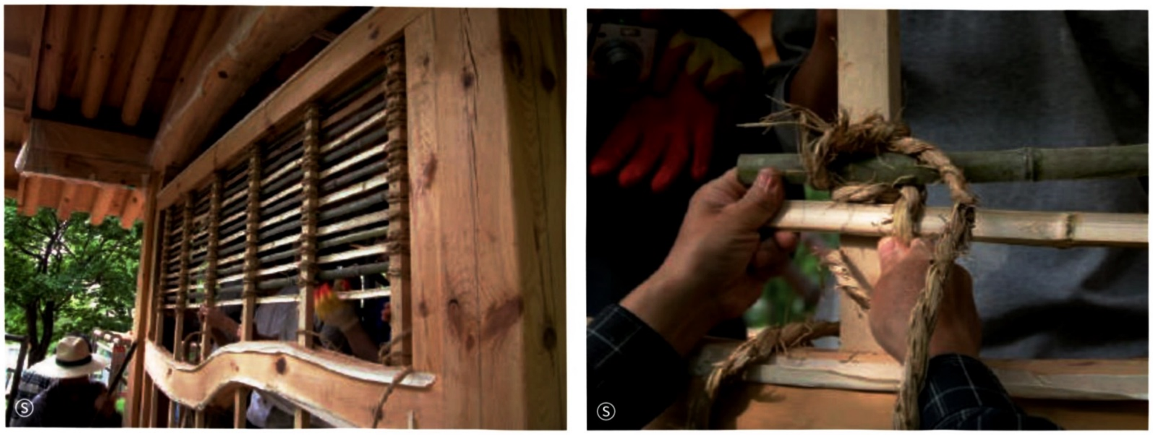


Checking verticality

‘Plastering wall[sujang]’ refers to the process of filling in the wall on the wall frame where components such as the lintel[inbang], wainscot[meoreum], wall stud[byeokseon], jamb[munseon] have been assembled. Simbyeok, the method of weaving regular-sized laths[junggit] and thinner laths[oe] and plastering mud on top is typically used for the Hanok.

1. lathwork[oeyeokgi]

Lathwork[oeyeokgi] refers to the process of weaving lattices, primarily two kinds of laths[junggit] and thinner laths[oe], to form the frame of the mud wall. The laths[junggit] is a long component about one-third of the lintels thickness’ and is placed vertically at regular intervals in between lintels. In between those, thinner branches or split bamboo called nuloe(horizontal laths) are woven horizontally. Then vertical laths[seoloe] are woven in between the laths[junggit] regularly with the horizontal laths to complete the mud wall frame.



1 2 | Lathwork

2. inner wall-first plastering[chobyeok-bareugi]

Inner wall-first plastering[chobyeok-bareugi] is the process of plastering the inner wall on the frame made by lathwork[oeyeokgi]. The inner wall is plastered first because it takes longer to dry than the outer wall. A mixture of mud, sand, and finely chopped straw is used as the plaster.

3. outer wall-first plastering[matbyeok-bareugi]

Outer wall-first plastering[matbyeok-bareugi] refers to the process of plastering the outer wall with the same method as the first plastering of the inner wall.

4. dubbing out[goreumjil]

Dubbing out[goreumjil] refers to the process of filling in dents and gaps with mud after the first plastering to form a smooth surface.

5. second plastering[jaebyeok-bareugi]

Second plastering[jaebyeok-bareugi] is the process of applying a second plaster to the wall where the first plastering and dubbing out are finished. A mixture of finer sand and straw with water is used as the plaster.

6. setting plaster[jeongbeol-bareugi]

Setting plaster[jeongbeol-bareugi] is the last step of making the mud wall and has various types depending on the plaster material; hoebyeok only uses lime, sabyeok uses a mixture of mud and sand, and hoesabyeok uses a mixture of mud, sand, and lime.

1 2
3 4
5

—

1 Inner wall-first plastering
2 Outer wall-first plastering
3 Dubbing out
4 Second plastering
5 Setting plaster

23

finishing[magam]

마감 / —— / 仕上げ[しあげ]

❶ **paintwork**[dancheong]
단청[丹青] / 彩画[cǎihuà] / 彩色[さいしき]

❷ **oil coating**[gireum-meogigi]
기름먹이기 / ——— / 油性塗料塗り[ゆうせいとりょうぬり]

'Finishing[magam]' refers to the process of coating the surface after all the woodwork is finished in order to protect the wood from decay and parasites. Common private households would finish by coating with oil, but for temples or palaces, five elementary pigments would be used to apply traditional paintwork[dancheong].

1. traditional paintwork[dancheong]

Traditional paintwork[dancheong] refers to the process of painting with red, blue, yellow, black and white which are the elementary colors according to the eastern philosophy of Cubic Five Elements. Usually lines or lotus patterns are drawn with a symbolic meaning, but solid color painting is also possible and is called gachil-dancheong.

2. oil coating[gireum-meogigi]

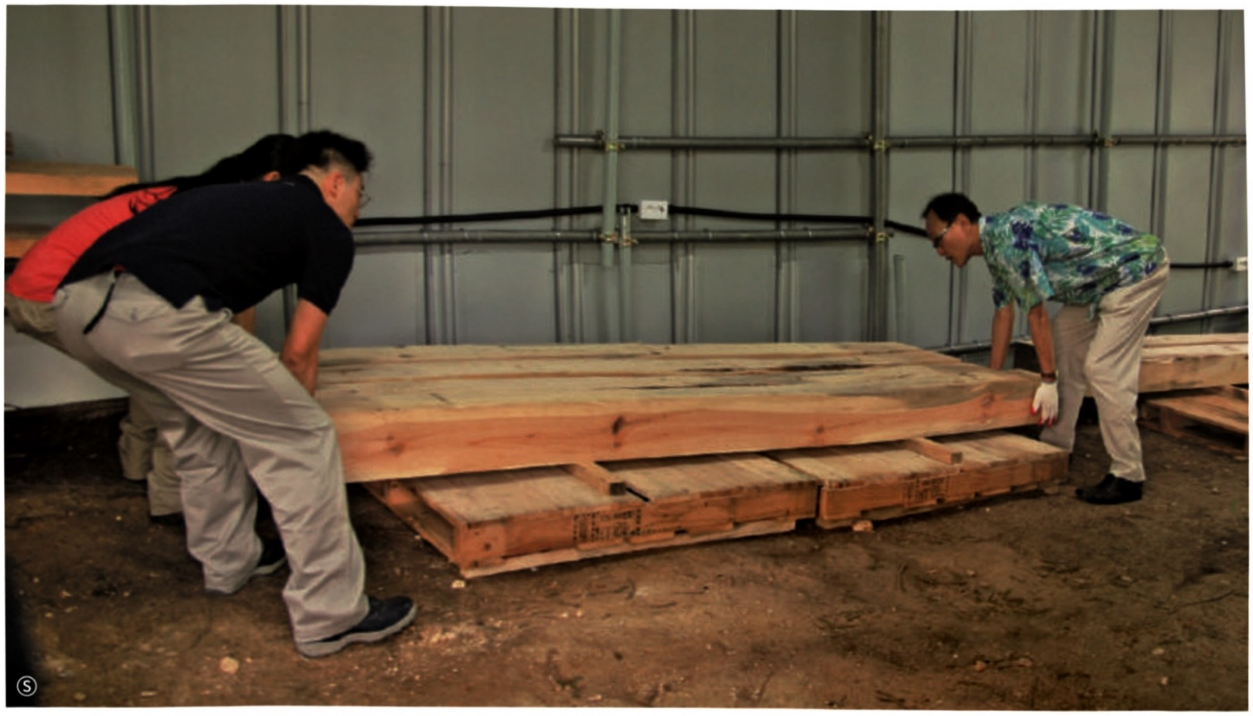
Oil coating[gireum-meogigi] refers to the process of oil coating the surface of the wooden members or the painted surface for protection. After assembling the Hanok, the final trimming, and filling in dents to make a smooth surface, bean water made by soaking fresh beans or perilla oil is used to oil coat.

Oil coating

24

pallet block[motang]

모탕[隅湯] / 垫木[diànmù] / 台木[だいぎ]



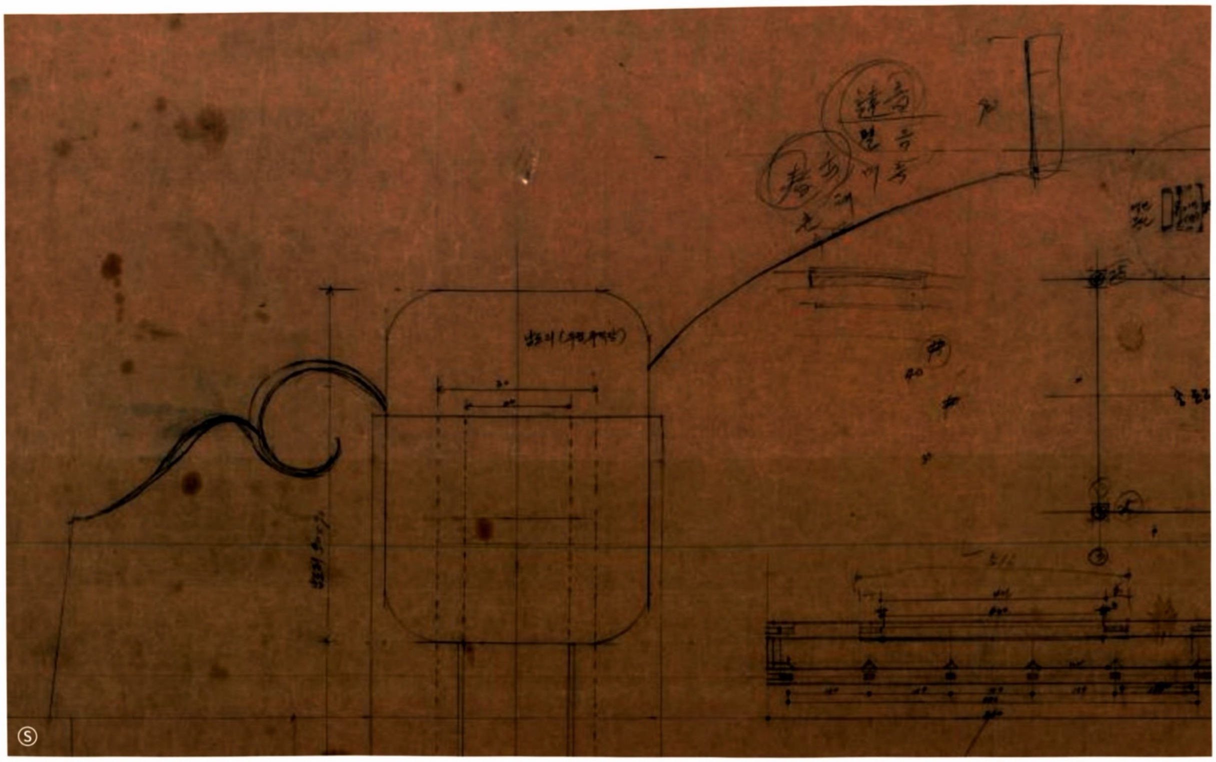
Pallet block

The 'pallet block[motang]' refers to either the work bench on which timberwork is done or the wooden block that is used to prop up the timber pile. The pallet block may damage the timber depending on its shape, position, and solidity. If the pallet block is too solid, the timber laid on top can be damaged; if the pallet block is too low, the wood will not be well ventilated; if the pallet block is too wide, the surface touching the timber will be damp and leave a mark. Therefore, on the very bottom, the biggest pallet block should be placed in the exact horizontal balance so that piled-up timbers will not bend or twist. When placing each bundle of timber, evenly pile up pallet blocks so that the center of weight is not shifted and pay attention to create an environment where each timber can be well dried.

25

carpenter's construction drawing[dohaengpan]

도행판[圖行板] / 风水罗盘[fēngshuǐluópán] / 板図[いたず]



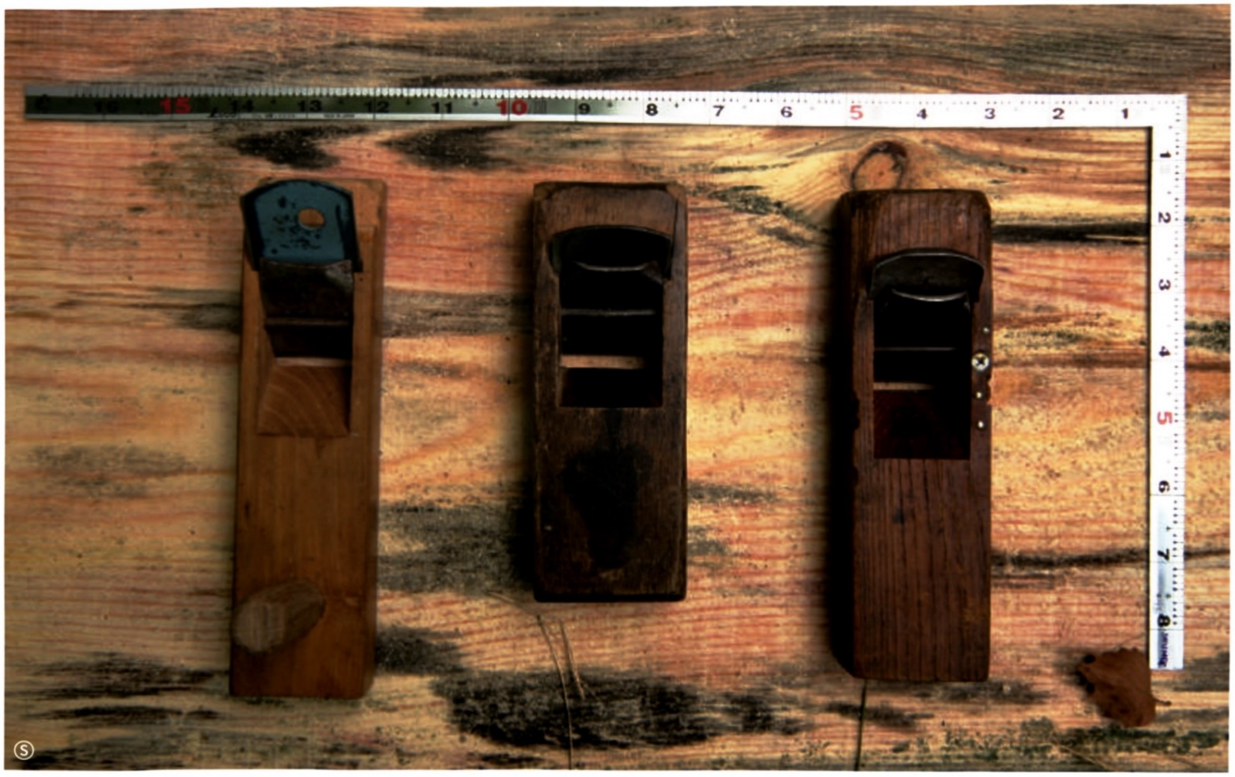
Carpenter's construction drawing

The 'carpenter's construction drawing[dohaengpan]' is a simplified plan that the carpenters draw on a board on the site. It is used to check agreed details or progress among carpenters. The order and placement of members, including the columns, beams, and purlins, are marked. Usually the corner column[wuju] on the left upper side is marked 'A1' and in the beam direction proceeds by alphabetical order of 'A, B, C…', and in the purlin direction, the numbering proceeds by numeric order of '1, 2, 3,…'.

26

plane[daepae]

대패[鏟] / 刨子[bàozi] / 鉋[かんな]



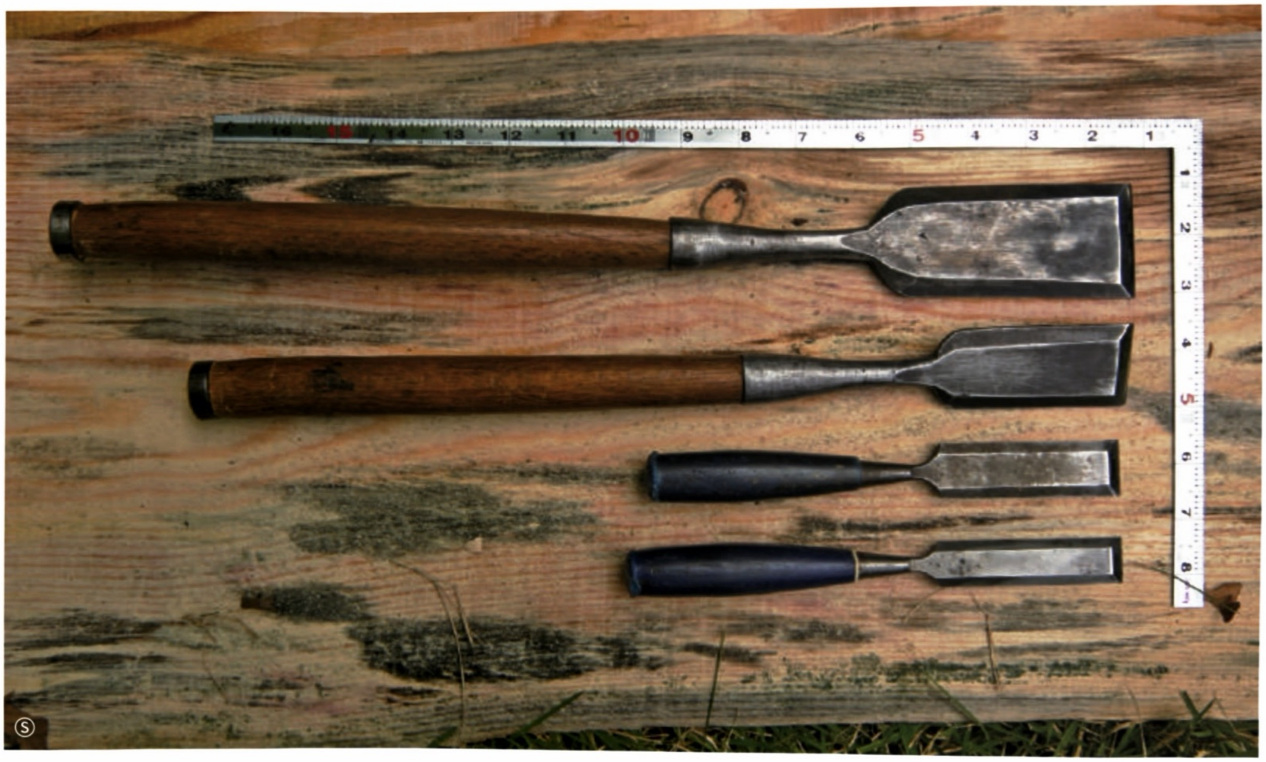
Plane

The ‘plane[daepae]’ is a tool to smoothly plane the timber or carve in a particular shape. Depending on the usage, and shape of the body and cutting iron, there are various types; the most basic flat plane[pyeong-daepae] which planes a flat surface, the grooving plane[banteok-daepae] that carves a raised groove on the side of the timber, and the molding plane[soesiri-daepae] that carves special shapes on the surfaces and edges of wall frames.

27

chisel[kkeul]

끌[鋧] / 凿子[záozi] / 鑿[のみ]

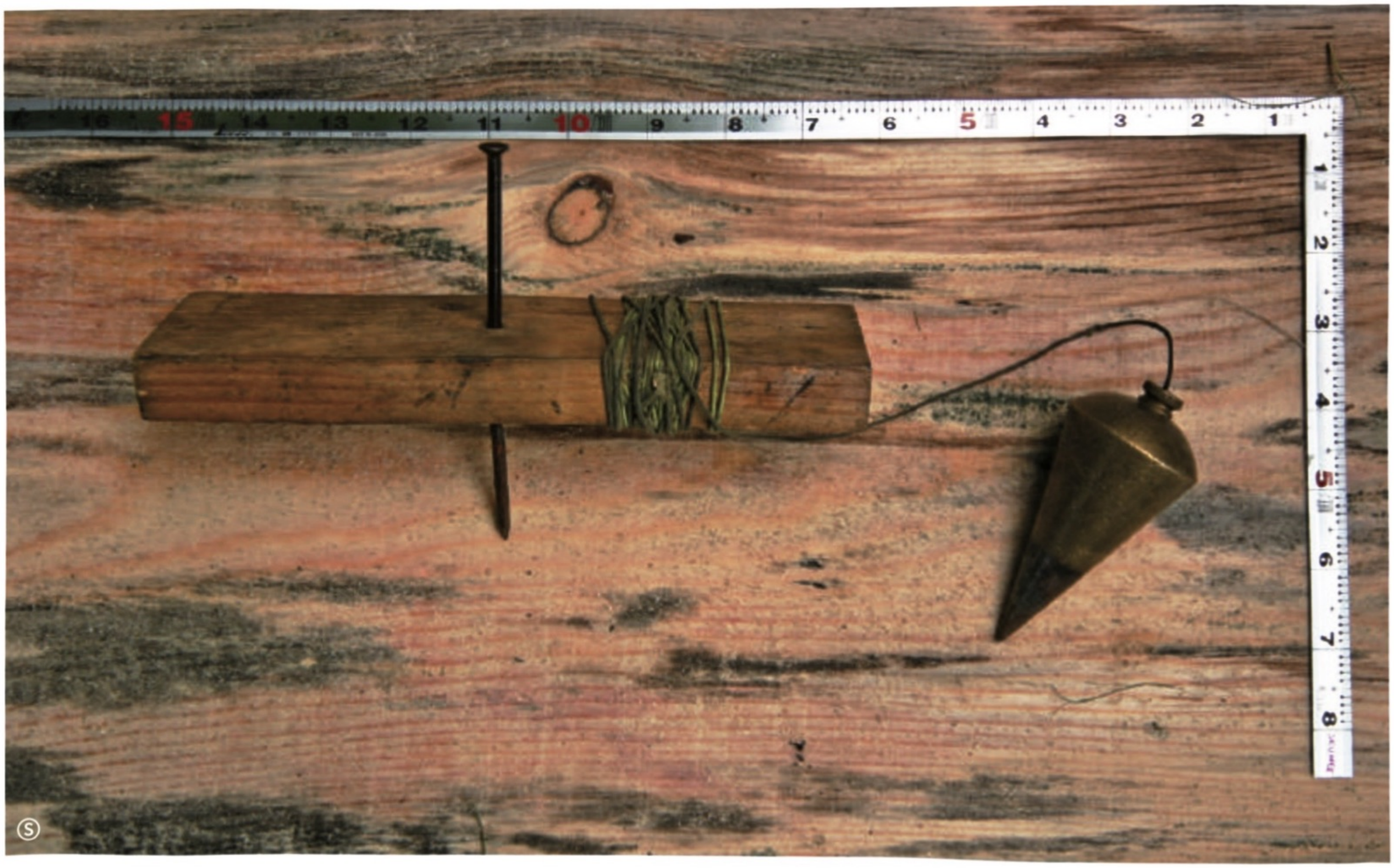


Chisel

The 'chisel[kkeul]' is a long thin metal tool that is used to carve grooves in the timber. It is mainly used to carve the mortise[jangbu-gumeong] and has various types depending on the width and shape of the blade. Often used types are the round nose chisel[dunggeun-ggeul] and butt chisel [neopjeok-ggeul].

plumb bob[darimchu]

다림추[錘] / 铅锤[qiānchuí] / 下げ振り[さげふり]



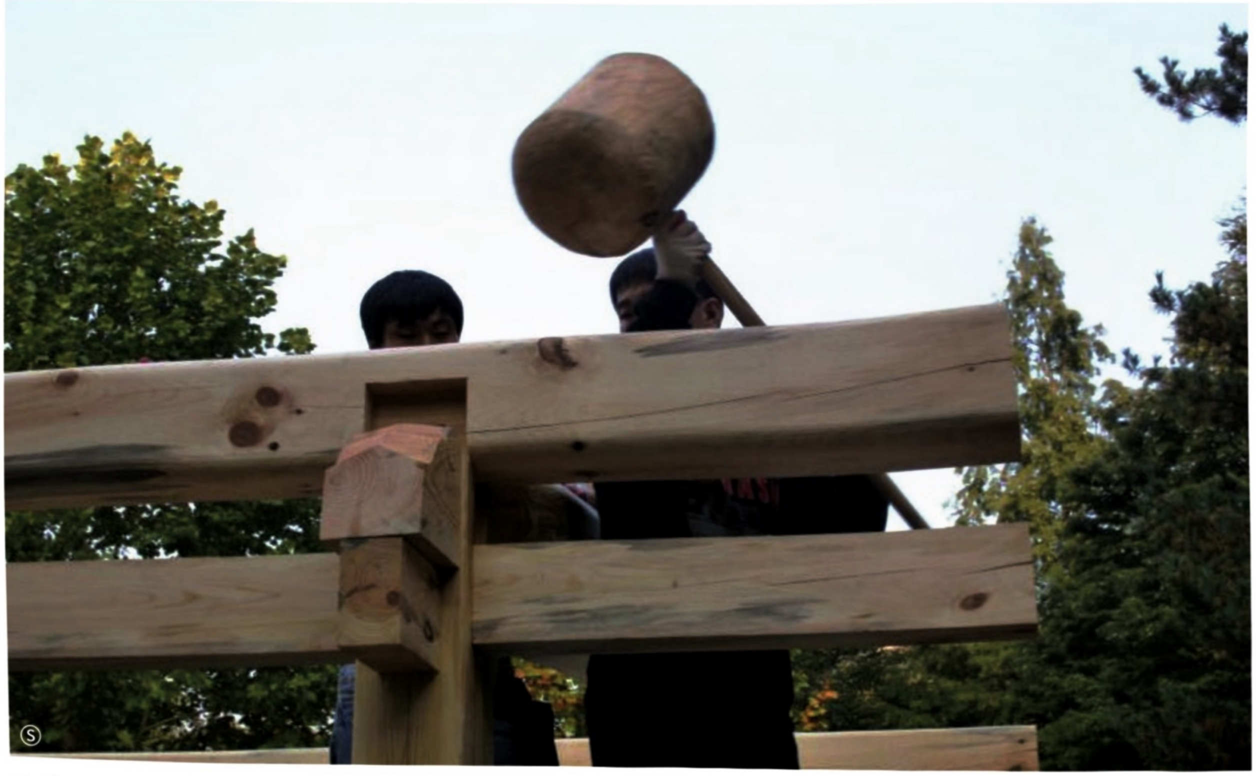
Plumb bob

The ‘plumb bob[darimchu]’ is a tool to check if an object is perpendicular and is used when raising columns. To use as a plumb bob, a heavy object is hung on a thin string.

29

mallet[me]

메[鈉] / 木锤[mùchuí] / 掛矢[かけや]



Mallet

The 'mallet[me]' is a large and heavy mallet used to pound down and assemble the members. It is usually made by drilling a hole into a large wooden block and attaching a handle. Because timber is easily transformed by shrinkage due to temperature and climate change, it is important to minimize cracks of the timber in the timberwork and then assemble with a mallet.

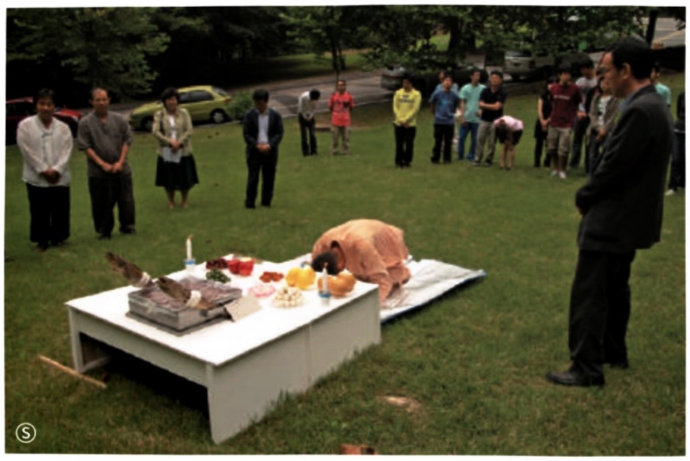
30

ground-breaking ceremony[gaetoje]

개토제[開土祭] / 破土仪式[pòtǔyíshì] / 地鎮祭[じちんさい,とこしづめのまつり]

❶ ground-breaking letter[goyumun]
고유문[告由文] / ——— / 祝詞[のりと]

The 'ground-breaking ceremony[gaetoje]' is the ground breaking ceremony and is also called the 'gaegi-je'.[8] It is a ceremony to tell the god of the earth that construction has started and ask for permission to use the land and wish for everything to proceed safe and sound during the construction. This ceremony is also held before construction of graves.

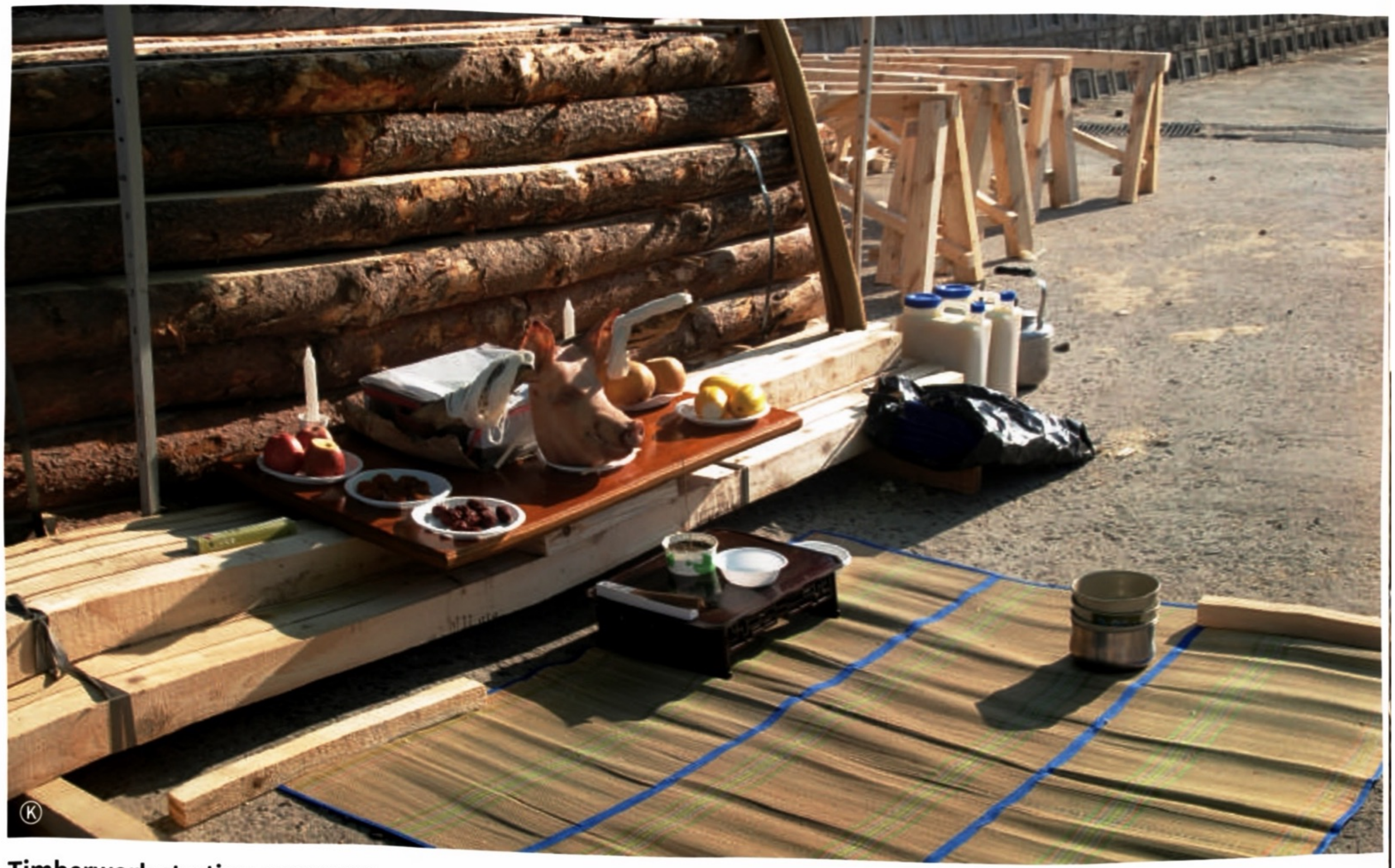


Ground-breaking ceremony

ground-breaking letter[goyumun]

When serving the ground-breaking ceremony, a letter which is called the goyumun is read to thank the god of the earth and ask for caring.

모탕고사[隅湯告祀] / —— / 安全祈願祭[あんぜんきがんさい]



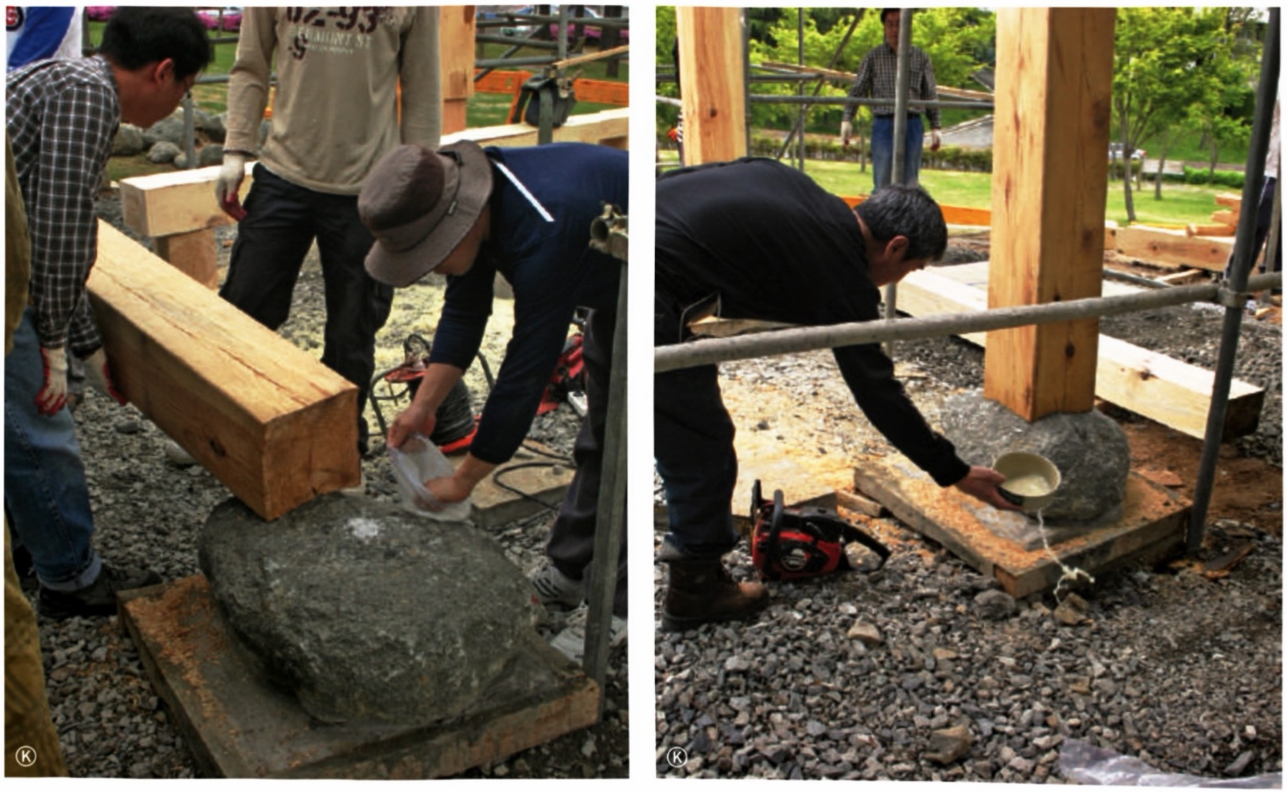
Timberwork starting ceremony

The 'timberwork starting ceremony[motang-gosa]' is a ceremony held after transporting and storing the timber. It is to wish for the safe storage of the timber, the main building materials of the Hanok, and the safety of the carpenters. While the ground-breaking ceremony is held by the owner of the Hanok, the timberwork starting ceremony[motang-gosa] is held by the carpenters. The carpenters lay out their tools, including the ruler, ink well, ink pen, and plane for the ceremony.

32

column erecting ceremony[ipjusik]

입주식[立柱式] / —— / 立柱式[りっちゅうしき]



Column erecting ceremony

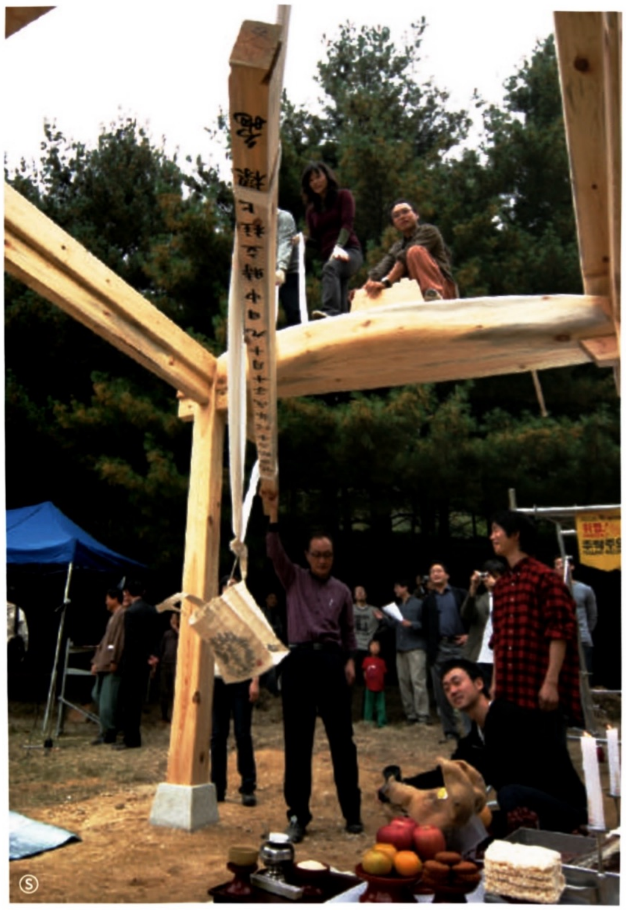
The 'column erecting ceremony[ipjusik]' is a ceremony held after the timberwork is finished and the columns are raised on the base stones. The process of raising the columns initiates the Hanok assembly, and after this, large and heavy members are lifted. Therefore the column erecting ceremony is held to wish for safety and encourage carpenters. In the past, erecting the columns was such an important step that even an appropriate date, time, location, and direction for the ceremony was appointed. After holding ancestral rites in front of the columns, salt

33

framework completion ceremony[sangryangsik]

상량식[上梁式] / 上梁仪式[shàngliángyíshì] / 上棟式[じょうとうしき]

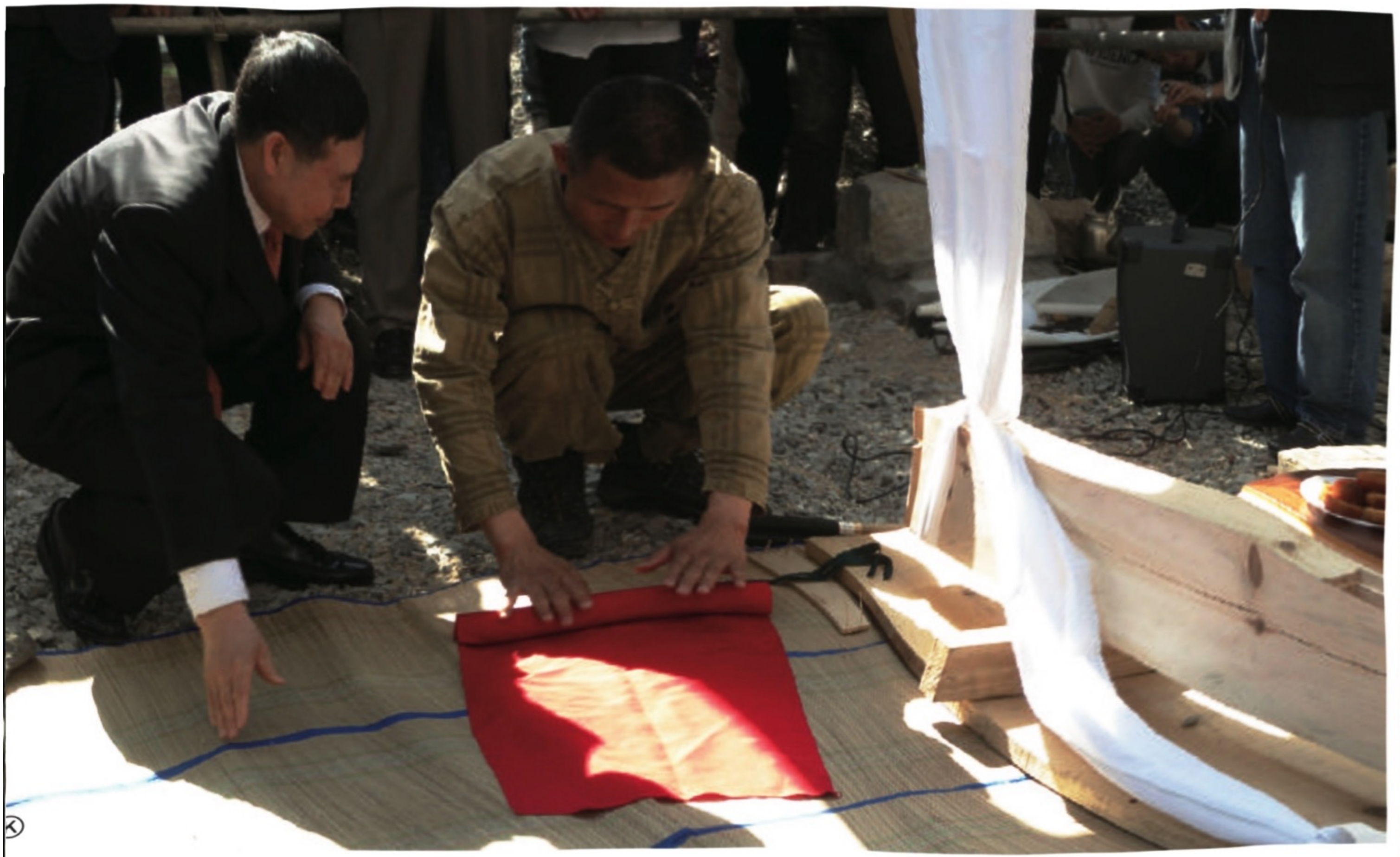
❶ **framework completion letter**[sangryangmun]
상량문[上梁文] / 上梁祭文[shàngliángjìwén] / 棟札[むなふだ]

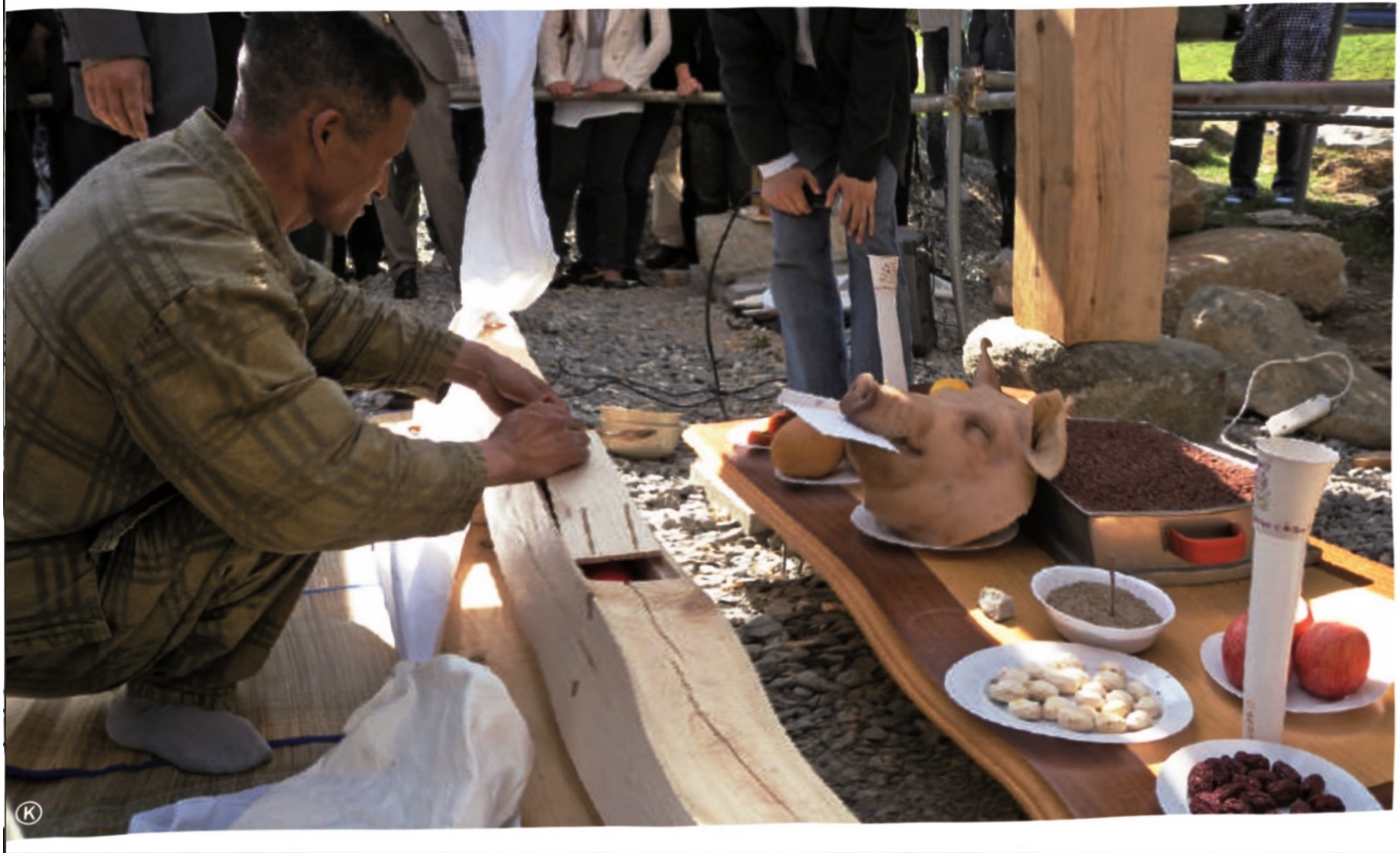


Framework completion ceremony

The 'framework completion ecremony[sangryangsik]' is the biggest ceremony during the Hanok construction and has been considered an important process along with the ground-breaking, laying the column base stones, and column erecting. It is held when the frame of the Hanok is completed; during the ceremony, the one top purlin[jongdori], which is the upper most member of the Hanok is placed. It is to give thanks for a safe construction and appreciate the carpenters for their hard work. The framework completion letter[sangryangmun] is placed inside the top purlin support[jongjangyeo], which contains the Chinese characters 'turtle' and 'dragon' that have the meaning of protecting the house from fire, and the date when the Hanok is built. Pork, rice cake, fruits, and liquor are prepared as offering. The carpenter ties cotton fabric on each truss post where the top purlin support will be placed, ties the top purlin support underneath, and raises it up from both sides at the same time. The top purlin support is pounded down with a mallet to be joined with the ridge piece[jongdori]. This indicates the completion of Hanok's framework.

nework completion *letter*[sangryangmun].





34

completion ceremony[jungongsik]

준공식[竣工式] / 竣工典礼[jùngōngdiǎnlǐ] / 竣工式[しゅんこうしき]

Naming a Hanok

The 'completion ceremony[jungongsik]' is a ceremony held after the Hanok construction is completed. The moving-in ceremony[ipjusik], meaning that the owner enters the completed Hanok for the first time, and the 'naming ceremony[hyeonpansik]' for naming the Hanok are held together. It is to congratulate the completion of the Hanok and appreciate the carpenters for their hard work. After the ceremony, participants share food and celebrate.

ompletion of the Hanok

Building Hanok

Components & Techniques

Author	National Hanok Center
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